



Middlesex University Research Repository

An open access repository of
Middlesex University research

<http://eprints.mdx.ac.uk>

Ball, David J. (2002) Playgrounds - risks, benefits and choices. HSE contract research report 426/2002 . HSE Books. ISBN 0717623408

Available from Middlesex University's Research Repository at
<http://eprints.mdx.ac.uk/4990/>

Copyright:

Middlesex University Research Repository makes the University's research available electronically.

Copyright and moral rights to this thesis/research project are retained by the author and/or other copyright owners. The work is supplied on the understanding that any use for commercial gain is strictly forbidden. A copy may be downloaded for personal, non-commercial, research or study without prior permission and without charge. Any use of the thesis/research project for private study or research must be properly acknowledged with reference to the work's full bibliographic details.

This thesis/research project may not be reproduced in any format or medium, or extensive quotations taken from it, or its content changed in any way, without first obtaining permission in writing from the copyright holder(s).

If you believe that any material held in the repository infringes copyright law, please contact the Repository Team at Middlesex University via the following email address:

eprints@mdx.ac.uk

The item will be removed from the repository while any claim is being investigated.



Playgrounds - risks, benefits and choices

Prepared by
Middlesex University
for the Health and Safety Executive

CONTRACT RESEARCH REPORT
426/2002

Playgrounds - risks, benefits and choices

Professor David J Ball
Middlesex University
School of Health & Social Sciences
Centre for Decision Analysis
& Risk Management
Archway Campus
2-10 Highgate Hill
London N19 5LW

This report describes the first detailed strategic risk assessment of outdoor playgrounds in the UK for over a decade. It also reviews international research on risk factors. In summary, the risk of injury on UK playgrounds is found to be modest compared with the risks of many other activities in which children are encouraged, for accepted reasons, to participate. The main risk factors on playgrounds are found to be behaviour, equipment height, and body orientation in falls to the ground (not necessarily in that order). Scientific evidence of the effectiveness of compliant undersurfacing as a risk mitigation measure is mixed. While some research points to a positive benefit the associated risk factor is relatively small and the question remains of how the measure affects child safety in the round. From a legal perspective, the question also arises as to whether the projected benefit, if accepted, is sufficient to meet the British safety criterion of reasonable practicability. It is noted that over the past decade, during which there have been many playground safety interventions, coupled perhaps with less usage of playgrounds, there is as yet no sign of a downward trend in overall numbers of injury cases.

Importantly, there is a view that play provision may have reduced in quantity and possibly also in quality. This, it is thought, has been brought about by concern over accidents, litigation, cost of safety measures et cetera. A problem for play providers is that these concerns are very tangible, whereas the benefits of play, social, physical and psychological are far less easily quantified. The appropriate balance between play benefits, one of which is considered by leading play agencies to be the opportunity to experience real risk, and safety on playgrounds, is a social and not a scientific matter, and may warrant careful reconsideration. Some risk management measures are suggested which might be helpful. It is also recommended that, in the interests of child safety, risk assessment should be applied to the activities of children both on and off playgrounds to safeguard against plausible risk transfer mechanisms and to optimise child safety overall.

This report and the work it describes were funded by the Health and Safety Executive. Its contents, including any opinions and/or conclusions expressed, are those of the authors and do not necessarily reflect HSE policy.

© Crown copyright 2002

*Applications for reproduction should be made in writing to:
Copyright Unit, Her Majesty's Stationery Office,
St Clements House, 2-16 Colegate, Norwich NR3 1BQ*

First published 2002

ISBN 0 7176 2340 8

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means (electronic, mechanical, photocopying, recording or otherwise) without the prior written permission of the copyright owner.

CONTENTS

ACKNOWLEDGEMENTS

1. INTRODUCTION

- 1.1 Background
- 1.2 Objectives
- 1.3 Report Structure

2. AN OVERVIEW OF PLAY INJURY CASES IN THE UK

- 2.1 Non-fatal injuries – *where and how many?*
 - 2.1.1 Data from the LASS reports
 - 2.1.2 Play equipment product-related accidents and the LASS data base
 - 2.1.3 Numbers of equipment-related cases by location
- 2.2 Fatalities in playgrounds
- 2.3 An overview of where and how many

3. TYPES OF INJURIES AND CAUSAL FACTORS

- 3.1 Fatalities
- 3.2 Non-fatal injuries

4. ASSESSING RISKS

- 4.1 Studies of perspective
 - 4.1.1 International data
 - 4.1.2 UK data
- 4.2 Studies of playground risk factors
- 4.3 Biomechanical studies of falls
- 4.4 Impact attenuation of surfaces
- 4.5 Play observed minutely
 - 4.5.1 The PRAV study
 - 4.5.2 Real time observation

5. ASSESSING BENEFITS

- 5.1 Why consider benefits?
- 5.2 Unavoidable difficulties associated with play benefits
- 5.3 Modest evidence
- 5.4 Playground risks – a step on the road to coping with life?

6. BEHAVIOUR versus ENVIRONMENT

- 6.1 Social approaches to understanding play and behaviour
- 6.2 Environmental approaches to safety
- 6.3 Behaviour versus environment

7. ANALYSIS AND REVIEW

- 7.1 How dangerous are playgrounds in the UK?
- 7.2 Why the focus on safety in the playground?
- 7.3 What is the meaning of 'safety'?
- 7.4 The effectiveness of safety measures
- 7.5 Threats to playgrounds
- 7.6 The problem of balance

8. CONCLUDING DISCUSSION AND RECOMMENDATIONS

- 8.1 The key issue is balance
- 8.2 Safety on and off playgrounds
- 8.3 Safety on playgrounds
- 8.4 Standards
- 8.5 Good practice
- 8.6 Playground surfacing
- 8.7 Research needs

APPENDIX A Analysis of the 1998 DTI LASS data set

APPENDIX B Further analysis of trends

APPENDIX C Risk-benefit analysis and alternative playground surfacing

APPENDIX D The application of cultural theory to playgrounds

ACKNOWLEDGEMENTS

Although the views finally expressed in this report are necessarily the responsibility of the author, the analysis and the formulation of these ideas has been greatly assisted by discussions held with numerous parties. Space is insufficient to thank everyone, but the following organisations in particular are gratefully acknowledged for their invaluable support throughout this project:

- all of the members of the UK Play Safety Forum as hosted by the Children's Play Council
- the DTI's Consumer Safety Unit
- staff of the Glasgow office of the HSE

Many individuals have also provided data, offered comments and given advice. Special mention is due to Amy Yan, Helen Vicary and Phil Raine of the DTI CSU, Robin Foster and Fiammetta Gordon of HSE (Rose Court), David Chalmers (IPRU, University of Otago) and Steve Marshall (formerly of IPRU and now of the University of North Carolina), Ian Burks (Keep Our Children Safe Campaign and Fairplay), Tim Gill of the Children's Play Council, Robin Sutcliffe (chair of the PSF), Jean Wenger (NPFA), Peter Heseltine (RoSPA), Diane Pain (formerly research officer for PRAV), and Joan Wood of Learning Through Landscapes.

1. INTRODUCTION

1.1 BACKGROUND

Childhood injuries incurred on playgrounds have attracted considerable attention in Britain and many other countries over the past several decades. Apart from children themselves, a surprising number of stakeholders is involved with or has an interest in this issue. These include play providers, particularly local authorities at various levels but also including schools and the education sector more widely, the private sector and charities, plus equipment manufacturers, playground designers, parents, play promotional agencies and other special interest groups, standards-setting bodies, insurers, solicitors, assorted experts, the courts, regulatory bodies, advisory bodies, the health service, the media and academics from various disciplines.

In the United Kingdom, the regulatory authority with respect to playgrounds is, by dint of the Health and Safety at Work Act 1974 (HSWA), the Health and Safety Executive. The reason for the relevance of this Act to playgrounds is to be found in Section 3 of the Act which contains provisions to protect people who may be affected by work activities even though they are not employees of the business or undertaking concerned. Crucially, this includes visitors to premises including the public and their children.

The fundamental purpose of this report is to provide an up to date review of knowledge on the safety of playgrounds. There are several reasons why it is appropriate to do this now. Paramount is the concern over safety itself which has been with us for two or three decades and shows little sign of abating. However, there is also another side to this issue that warrants consideration. Perhaps the most pressing aspect of this arises from the awareness in some circles of the importance of play for the development of children,¹ coupled with genuine anxiety that play opportunities may be less than adequate or otherwise under threat, because of escalating costs of provision, fear of litigation, and what has even been termed the '(over-)rigid application of Standards',^{2, 3, 4} together with more general concerns about an alleged 'loss of children's independence' and an associated, well-intentioned, but potentially harmful circumscription of their lives.⁵

While it is not to be expected that a predominantly (though not exclusively) scientific review could resolve matters as complex as these, it would nonetheless be mistaken to ignore what information there is. Furthermore, under the HSWA, there is an implied duty to conduct risk assessments of hazards. In part, this requires duty holders, in this case play providers, to be conversant with research that sheds light on the hazards within their remit, and it is an aspiration

¹ See, for example, 'Best Play' by the National Playing Fields Association, PLAYLINK and the Children's Play Council, March 2000, ISBN 094 6085 33; or numerous academic texts such as 'Risk and our pedagogical relation to children,' by S. J. Smith (State University of New York Press, 1998), or web site www.users.globalnet.co.uk/~estutz/index.html.

² R. Sutcliffe, keynote address to Playing Out Seminar, 18 May 2000.

³ G. Valentine and J. McKendrick, 'Children's outdoor play: exploring parental concerns about children's safety and the changing nature of childhood,' *Geoforum*, 28 (2), 219-235, 1997.

⁴ D. McNeish and H. Roberts, 'Playing it safe: Today's children at play,' Published by Barnado's, 1995.

⁵ M. Hillman, 'Children's development in a civilised society,' *Play Action, Fair Play for Children*, Autumn 1999.

of this report that it will provide a useful and accessible summary of current research for those agencies.

Secondly, it should not be overlooked that play equipment provision in Britain has become a multi-million pound business with annual turnover in excess of £50 M.² These costs are picked up by play providers who pass them on to taxpayers. Provision of playgrounds gives rise to additional costs which arise from installation, maintenance, inspections, insurance and litigation and, over a typical playground's lifetime, these can be expected to substantially exceed those of the equipment alone.⁶ With sums of this order involved it is appropriate to ask about value for money.

Thirdly, it is now over a decade since the first major review of playground accident statistics in Britain was published.⁷ At that time (1989) the relevant UK national database on leisure accidents was still at an evolutionary stage and many inferences had to be drawn or supported by information from sources remote from the UK. We now have the comparative luxury of an established and regularly-compiled UK accident database under the auspices of the DTI Consumer Safety Unit's Leisure Accident Surveillance System (LASS) of which full use should surely be made.⁸

1.2 OBJECTIVES

The project objectives were agreed as follows:

- To interrogate the data on playground accidents in the DTI's LASS database and other relevant databases such as the HSE's own injury reporting system⁹ with the aims of assessing risks, identifying trends, and seeking information on causal mechanisms
- To search national and international publication databases for scientific studies dealing with playground safety, including related topic areas such as epidemiology and biomechanics, and review and summarise this material and assess its relevance in the UK context
- To consider evidence on the effectiveness and practicability of remedial measures for reducing the rate and severity of injuries
- To discuss the scale and magnitude of playground accidents in terms of sport and leisure accidents and accidents in general
- To discuss the playground safety situation with respect to UK and HSE policy positions on the management of risk
- To draw conclusions on good practice and propose recommendations for further research as necessary

⁶ K. S. Kutska, 'Playground maintenance: rudiments and recommendations – the next generation,' Proceedings of 'Playground Safety,' Penn State, 1999, edited by M. L. Christiansen. ISBN 0 960342 1 6.

⁷ K. L. King and D. J. Ball, 'A holistic approach to accident and injury prevention in children's playgrounds,' 1989. Available from the authors c/o 3 Anchor Quay, Norwich NR3 3PR, UK. ISBN 871970 00 8.

⁸ The Consumer Safety Unit is in the Competition Policy Directorate of the UK Department of Trade and Industry.

⁹ The primary value of the HSE's system here is that it reports fatalities. These are not included in the LASS database.

So far as this report is concerned, playgrounds are taken as those which are outside and containing fixed equipment. Some data are included on indoor play and adventure play, but not as the primary focus. This is *not* in the least meant to imply that other kinds of play are unimportant.

1.3 REPORT STRUCTURE

This report is structured in a specific way for specific reasons. Experience shows that all too often, in whatever field of safety, risk assessments are conducted as if these were the sole requirement for decision making on the desirability of safety interventions. This is not the case. Risk assessment is no more than its name implies – an assessment of the probability of harm and the type of consequence arising from some identified hazard.¹⁰ Thus, risk assessment is only the first step in the process of managing a risk (see Figure 1).

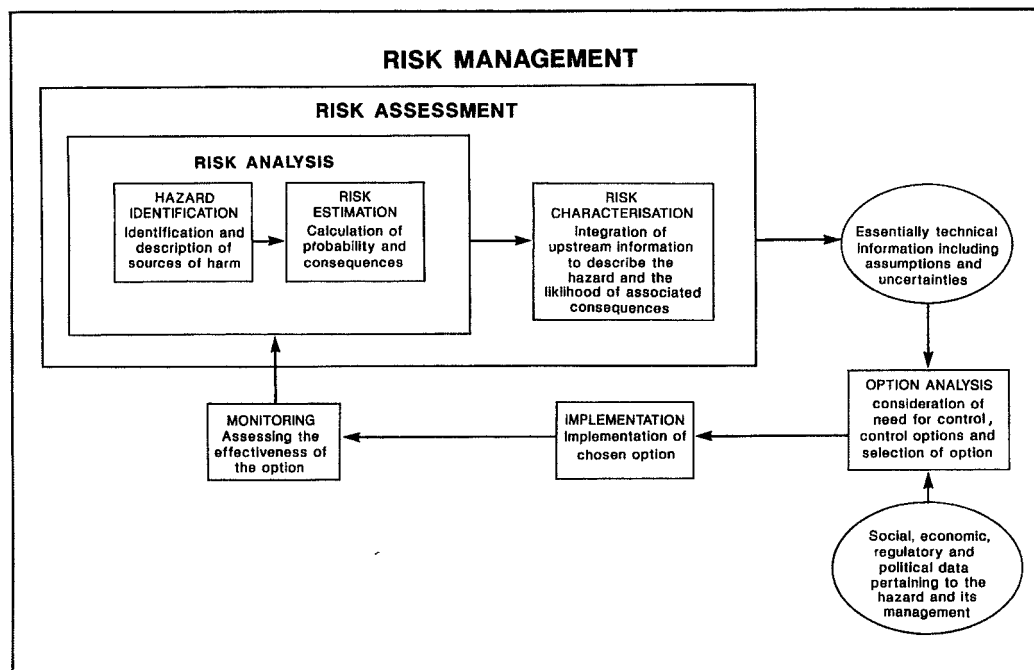


Figure 1: Risk assessment is only a *part* of the risk management (or decision) process.¹¹

Once a risk has been assessed, additional information is required on the control options available, in particular, their effectiveness, cost and difficulty of implementation, and whether the measures themselves have any additional consequences, which may be either beneficial or detrimental.¹² Furthermore, consideration must be given to the purpose of the hazardous activity (or product)

¹⁰ 'Risk' is here taken to signify the probability of some defined type of harm arising from a particular situation or hazard. 'Hazard' is defined as a situation or product with the potential to cause harm, for example, an unprotected drop or a frayed rope.

¹¹ D. J. Ball, 'Risks of injury – an overview,' Chapter 19 in ABC of Sports Medicine, 88-91, 2nd edition, eds. Harries, McLatchie, Williams and King, BMJ Press, 2000. ISBN 0 7279 1366 2.

¹² Risk control measures frequently have undesirable as well as desirable consequences. For example, vaccination of cattle and sheep to curtail the spread of foot and mouth disease jeopardises the disease free status of stock.

that is being assessed. Failure to do this may lead to the adoption of remedial measures that undermine the very purpose of the activity. Risky activities are usually knowingly undertaken in order to achieve the associated benefits. A good example of this is car driving which poses an annual risk of being killed of about 1 in 10,000. This is by most standards a very high risk, but it is by and large tolerated because of the benefits of the associated mobility. Thus, risk management is about balanced decision making and this clearly requires consideration of factors beyond those emerging from risk assessment.

Chapter 2 of this report is the first step in this process, providing a summary¹³ of the in-depth investigation into the number of fatal and non-fatal injuries arising in UK playgrounds, whether in schools, parks, public places or other outdoor locations. Chapter 3 uses these same data to examine the types of injuries incurred and what evidence can be found from these sources on causality.

Chapter 4 serves two purposes. One is to place the above risks associated with playgrounds in perspective. This is attempted by drawing comparisons between geographical areas, and with some other activities of a largely similar nature. The second is to report on and assess scientific research into injury causation. Evidence is drawn mainly from epidemiological studies aimed at identifying 'risk factors,' from biomechanical studies that investigate the forces exerted upon the body following falls and the ability of the body to withstand them, and some very detailed studies which look closely at factors contributing to some specific accidents. Taken together, Chapters 2 to 4 provide the primary data pertaining to risk assessment.

Chapter 5, in contrast, is concerned with a brief review of some of the benefits of play, since benefits and risks have ultimately both to be considered in devising any reasonable risk management programme. The brevity of this Chapter is not a measure of its importance.

Chapter 6 is mainly concerned with behavioural and environmental factors which are believed to impinge on play.

Chapter 7 commences the process of integrating, or, where this is not possible, describing the disparate perspectives on the nature and purpose of playgrounds.

Chapter 8 draws conclusions and puts forward a number of tentative recommendations for consideration by the appropriate agencies.

To assist readers, Chapters 2 to 7 commence with short summaries of their main conclusions. Some of this information is repeated in the final Chapter, giving rise to a degree of repetition. However, the aim is to try to assist readers in gaining a rounded perspective on the disparate factors which arguably should be involved in decisions affecting play, so perhaps this is excusable.

¹³ A more comprehensive version is provided in Appendix A.

2. AN OVERVIEW OF PLAY INJURY CASES IN THE UK

Summary of Main Points from this Chapter

- The number of childhood accidents in the UK resulting from leisure activities, measured in terms of annual attendances at hospital and emergency departments (this being the principal UK measure), is 1.2 to 1.5 million. The number of these cases found to be attributable, however loosely, to fixed equipment in playgrounds, is estimated to have been 41,700 in 1998. This figure is substantially less than might have been expected from a superficial examination of published national statistics.
- The main locations where equipment-related playground accidents occur are public playgrounds, parks, schools, and public houses or restaurants.
- There is no evidence of a trend in the total number of playground equipment-related accidents over the period 1988 to 1999.
- In terms of fatalities in playgrounds, these are very rare in the UK. From 1986/87 to 1998/99 there are known to have been about three or four cases assignable to playgrounds.
- Accidents are fairly evenly distributed between swings, climbing frames and slides. It is not possible to draw firm conclusions about the relative safety of these types of equipment in the absence of data on usage.
- Some crude estimates are made of the numbers of accidents involving children on playgrounds who have had an accident but did not attend a hospital accident and emergency department.

2.1 NON-FATAL INJURIES – WHERE AND HOW MANY?

2.1.1 Data from the LASS Reports

The primary data source for non-occupational injuries in the UK is the DTI's LASS database.¹⁴ The LASS database contains data collected at a representative sample, currently eighteen, of UK hospital Accident and Emergency Departments. Thus the definition of an accidental injury so far as these statistics are concerned is *anything judged serious enough to warrant attendance at an A & E Department*. Obviously this definition is by no means ideal, but on the other hand the LASS database is nonetheless one of the best injury databases in existence. Persons reporting to the participating A & E Departments are questioned about accident circumstances and personal details, and specially trained clerks complete a form for each case which is then entered onto a

¹⁴ The LASS database covers accidents outside of the home. There is another DTI data base on non-fatal injuries which deals with the home environment (HASS) but this is not relevant to the present study.

computer database. Each year the DTI Consumer Safety Unit publishes very useful statistical summaries drawn from this database.

For the purposes of this project these annual reports have been studied for the period 1988 to 1998 inclusive. A key Table in these reports is one reporting the number of accidents during the year by location and age group. About 60 locations are listed, of which two are of particular interest here. These are ‘school playground’ and ‘public playground.’ These are the only two locational descriptions specifically mentioning ‘playground.’ Against school playgrounds a total of 7,589 cases is recorded for 1998, and for public playgrounds the figure is 1,652. These are the numbers of patients attending the sample of A & E Departments in the survey. National estimates can be produced by application of the appropriate scaling factor which, for that year, was 19.53. Thus, the projected number of school playground accidents in 1998 is 148,213 (95% confidence limits of 147,460 to 148,969 are cited), and for public playgrounds the figure is 32,264 (95% confidence limits given as 31,914 to 32,618).¹⁵

On the face of it these figures (see Table 1) provide crucial data on the size of the ‘problem’ in the UK. However, the story is certainly more complicated and care is warranted on several counts. For one thing, school playgrounds in Britain contain rather little in the way of conventional play equipment and if one were interested specifically in play-equipment related accidents rather than, say, slips, trips and falls or inter-person collisions, which are likely to dominate in school playgrounds, then the number given is misleadingly high. The same would apply, though to a lesser extent, to the public playground statistic. Secondly, it is known that play equipment is located in other settings besides schools and public playgrounds, for example, in parks, at public houses and restaurants, and so on. Account should be taken of these locations if a true national estimate is desired. Thirdly, careful scrutiny of the individual entries on the LASS database, as described in Appendix A, has revealed some coding and interpretational problems which particularly affect the

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Public playground	48	54	48	48	35	33	28	33	33	31	32
School playground	ng	ng	ng	ng	ng	136	135	122	136	139	148
Swimming pool^a	ng	32	27	26	24	26	23	24	25	25	24
Fairground/circus	13	14	11	12	10	11	10	9	10	9	10
Caravan/campsite	8	12	12	12	8	6	5	5	5	8	8
Outdoor sports area or field	348	306	266	291	265	283	259	235	255	276	275
Indoor sports facility	110	97	84	102	100	97	87	82	89	94	92
All LASS locations	3,185	3,492	2,991	3,231	2,877	3,505	3,187	2,940	3,237	3,265	3,102
All LASS locations (0 to 14 years inclusive)	1,311	1,454	1,199	1,296	1,177	1,397	1,283	1,180	1,257	1,304	1,221
All HASS locations	2,509	2,750	2,596	2,634	2,547	2,882	2,658	2,502	2,734	2,858	2,839
All HASS locations (0 to 14 years inclusive)	1,088	1,238	1,029	1,054	1,023	1,123	1,044	947	1,004	1,058	1,026

Table 1: Numbers of A & E attendances (1,000s) for selected LASS and HASS locations as reported in the DTI CSU’s annual reports. See the text for cautionary remarks. (ng – not given)

^aAt a sports facility (indoor, outdoor and unspecified)

¹⁵ These figures are for all ages, though the distribution of cases is so sharply curtailed above 16 years of age that the correction, if one wanted to limit it just to children of, say, 16 or less, would only amount to about 5%.

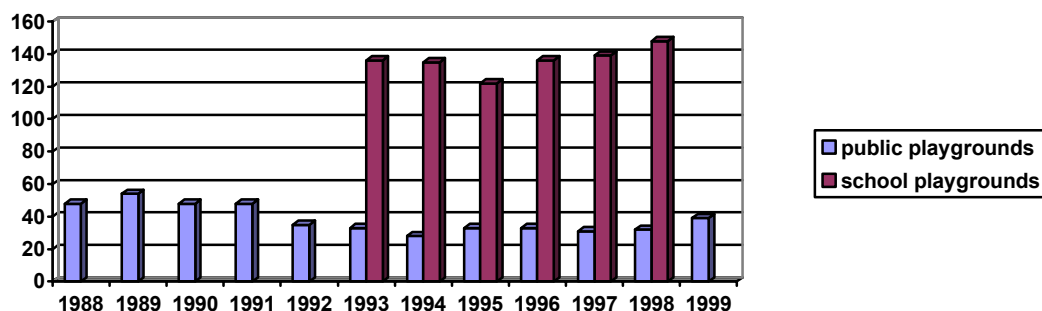


Figure 2: Crude numbers of LASS-reported public playground and school playground A & E cases from the late '80s to the late '90s. See text for cautions.

estimate for public playground cases. For example, an appreciable number of these cases appear to have occurred in other venues, and a further appreciable number, which probably did occur on playgrounds, had nothing much to do with playgrounds per se. For example, playing football, being stung by a wasp, or hit by a catapult projectile is not strongly linkable to playgrounds as such. Fourthly, it should not be overlooked that A & E attendances are only one outlet for injury cases. Others attend their GP, or specialist health outlets, or go home. Fifthly, attendance at an A & E department does not necessarily imply that an injury has occurred.

Although, as noted above, some care is required in interpreting the data in Table 1, it is still worthwhile to examine this information to see what kind of a picture it presents. On the face of it, Table 1 indicates that there have been about 170,000 to 180,000 public and school playground A & E cases per year for some years, plus whatever might be the number for other locations where play occurs. There is an apparent discontinuity in the public playground data as one moves from 1991 to 1992 but this is believed to be an artifact of the data or its method of collection. In fact, Table 1 provides no convincing evidence of any trend in numbers of playground accidents during the eleven years to which it refers (see also section 2.1.2).¹⁶

The remainder of the Table gives some yardsticks against which these numbers can be compared. Outdoor and indoor sports activities, for example, generate over 350,000 cases annually, and overall the LASS accident database records some 1.2 million cases of children attending A & E departments each year, and HASS (Home Accident Surveillance System) a further 1.0 million. So far as children are concerned, the only significant sector not covered by these statistics is transport. Unfortunately transport statistics are not collected in the same way and readily comparable data are not available for the UK. But, superficially at least, the data in Table 1 imply that upwards of 8% of home and leisure cases involving children are associated with playgrounds.

2.1.2 Play Equipment Product-related Accidents and the LASS Database

Apart from the above categorisation of accidents by locations, there is another important means of estimating numbers of accidents related to playgrounds from the DTI database. This is by

¹⁶ This is further substantiated by the LASS estimate for public playgrounds for 1999 which is 39,000 cases. Enquiries suggest the increase may be associated with changes in the reporting hospitals.

selecting specific play equipment products, such as swings and climbing frames, and finding how many cases are associated with them. The following national estimates of the numbers of cases involving the most commonly used pieces of play equipment have been calculated from the annual DTI HASS/LASS data summaries for the eleven year period to 1998. Table 2 gives data for home and leisure cases together, and Tables 3 and 4 for those occurring at home and in leisure separately.¹⁷

Of these Tables, Table 4 is the most important here (note: these data are also summarised in Figure 3). According to this, the overall number of cases of play equipment related accidents in leisure activities away from home has been fairly steady throughout the eleven year period and in the region of 50,000 to 70,000 each year, again without evidence of a trend over time (Appendix B takes a closer look at these data). In the initial stages of this project, effort has gone into exploring the relationship between this estimate and the much higher estimate based on the locational data in Table 1.

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
LASS multiplier	35.1	35.3	27.2	28.5	28.4	50.0	40.6	36.6	19.21	19.71	19.53
HASS multiplier	18.5	18.3	18.6	19.0	22.1	25.0	20.3	18.3	19.21	19.71	19.53
A: Swing	30.2	33.9	23.4	25.5	27.5	25.3	21.1	21.5	20.2	21.0	18.3
B: Rope swing	ng	ng	5.1	6.4	ng	6.9	6.7	7.1	6.8	6.9	5.2
C: Climbing frame	17.0	21.6	18.8	20.1	19.1	21.9	20.1	21.3	22.5	24.6	21.6
D: Slide	18.2	22.1	17.1	17.4	17.7	18.2	18.5	18.7	21.3	21.8	18.7
E: Seesaw	3.9	4.6	3.7	5.2	4.0	4.3	4.3	4.0	4.2	4.7	3.7
F: Roundabout	ng	3.4	2.2	3.6	2.5	3.4	2.4	2.7	2.2	2.4	1.9
G: 'Adventure'	ng	ng	Ng	1.3	1.2	0.7	0.7	1.0	1.0	1.0	1.3
Total (A to F)	69.2	85.6	70.2	78.3	70.9	79.9	73.1	75.3	77.2	81.3	69.5

Table 2: Estimated annual totals (1,000s) of playground product-related A & E attendances from 1988 to 1998 using HASS and LASS data. These totals include all venues where these products are used (i.e. homes, schools, public playgrounds, and commercial outlets etc.). The 'adventure' play category is based on a degree of definitional interpretation by LASS clerks and is not necessarily synonymous with other definitions.

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
HASS multiplier	18.5	18.3	18.6	19.0	22.1	25.0	20.3	18.3	19.21	19.71	19.53
A: Swing	6.0	7.8	6.0	6.2	5.9	6.5	5.8	5.9	6.0	6.6	5.9
B: Rope swing	ng	ng	0.4	0.6	ng	0.7	0.7	0.9	0.7	0.8	0.5
C: Climbing frame	3.2	3.7	3.1	3.1	3.5	3.3	4.0	3.6	4.0	4.6	3.3
D: Slide	3.6	4.1	4.0	4.1	4.6	5.3	5.4	5.0	6.1	6.7	5.3
E: Seesaw	0.6	0.7	0.6	1.0	1.0	1.3	1.1	0.7	1.2	1.3	1.0
F: Roundabout	ng	0.1	0	0	0	0.1	0	0	0	0	0
Total (A to F)	13.4	16.4	14.0	15.0	15.1	17.1	16.9	16.1	18.1	20.0	15.9

Table 3: Estimated numbers (1,000s) of play equipment related accidents occurring at home (HASS data base).

¹⁷ Play accidents at home are not the focus of this research and are included for interest only.

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
LASS multiplier	35.1	35.3	27.2	28.5	28.4	50.0	40.6	36.6	19.21	19.71	19.53
A: Swing	24.3	26.1	17.4	19.3	21.6	18.8	15.3	15.6	14.2	14.4	12.5
B: Rope swing	ng	ng	4.8	5.9	ng	6.2	6.0	6.2	6.1	6.1	4.7
C: Climbing frame	13.8	17.9	15.7	17.0	15.6	18.6	16.2	17.7	18.5	20.0	18.3
D: Slide	14.6	18.0	13.1	13.2	13.1	12.9	13.1	13.7	15.1	15.1	13.5
E: Seesaw	3.3	3.9	3.1	4.2	3.1	3.1	3.2	3.2	3.0	3.4	2.7
F: Roundabout	ng	3.2	2.2	3.6	2.5	3.3	2.4	2.7	2.2	2.3	1.9
Total (A to F)	55.8	69.2	56.2	63.2	55.8	62.8	56.2	59.1	59.1	61.3	53.6

Table 4: Estimated numbers (1,000s) of play equipment related accidents occurring during leisure activities not at home (LASS data base).¹⁸

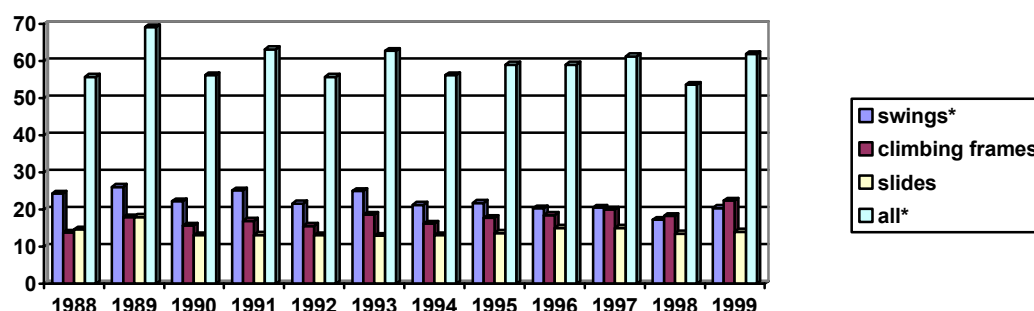


Figure 3: Trends in LASS-reported A & E cases (thousands) for selected items of equipment. Note: no allowance for usage or availability is made in this summary.

*Here, swings include rope swings which account for ~30% of swing cases. 'All' includes seesaws, roundabouts etc..

2.1.3 Numbers of Equipment-Related Cases by Location

The LASS database was interrogated by obtaining a printout by location of all cases mentioning one of six common types of play equipment (climbing frames, slides, seesaws, roundabouts, rope swings and swings). The results for 1998 are summarised in Table 5. According to this Table there were 4,746 (national estimate) cases in school playgrounds which may be compared with the figure of 148,000 in Table 1 for the same location, the huge disparity, it might be surmised, being attributable to the comparative scarcity of play equipment at schools.¹⁹ Likewise, the numbers of equipment-related cases associated with public playgrounds is 15,370 which may be compared with 32,000 in Table 1. Here the disparity is far less though still very significant.

There are additional features of interest in Table 5. These include the locations of the other equipment-related cases in the LASS database. These can be seen to include creches and nurseries,²⁰ public houses, other leisure facilities, parks, the countryside, other locations,²¹ and a

¹⁸ The LASS total for 1999 is 61,900 cases.

¹⁹ D. G. Lenaway, A. G. Ambler and D. E. Beaudoin (In 'The epidemiology of school-related injuries: new perspectives,' Am. J. Prev. Med. 8 (3), 193-198, 1992) find 36% of school playground injuries to be attributable to equipment in Colorado, though even this figure may be high compared with the UK.

²⁰ Creches are not of particular interest in this study which is primarily about outdoor play.

rather large category described as ‘unknown location.’ Another interesting feature is the type of equipment associated with cases in each location. For example, climbing frame cases dominate in school playgrounds (this is as one might expect given that these items are the most common in school playgrounds), whereas there is not a lot to choose between climbing frames, slides and swings in public playgrounds in terms of numbers of cases. Alternatively, in the countryside, cases are dominated by rope swings. It seems rather clear from these data that the numbers of cases in each location reflect the type of provision. The numbers say absolutely nothing about the comparative safety of, say, slides compared with swings or climbing frames.

Location	Climbing frame	Slide	Seesaw	Roundabout	Rope swing	Swing	Sum	National estimate
School	180	42	6	4	1	10	243	4746
Public playground	252	186	54	51	12	232	787	15370
Creche/nursery	15	12	2	0	0	0	29	566
Public house or social club	43	47	1	0	1	11	103	2012
Other leisure facility	22	70	0	3	3	2	100	1953
Parkland	150	92	40	23	28	146	479	9355
Countryside	1	0	1	0	66	3	71	1387
Other location	112	116	9	4	61	36	338	6600
Unknown location	163	126	27	13	67	198	594	11601
Total	938	691	140	98	239	638	2744	53590
National estimate	18319	13495	2734	1914	4668	12460	53590	

Table 5: Numbers of A & E cases associated with the main equipment types for all LASS locations in 1998 and corresponding national estimates.

Reference has been made to the large disparity in national estimates of cases between the data in Tables 1 and 5 for public and school playgrounds. Although there is a very plausible explanation, the difference is too large and too important to take for granted. Partly for this reason over 4,000 individual case records have been extracted from the LASS database and examined. These include all of the 1,652 records for public playgrounds in 1998 and 1 in 7 of those for school playgrounds. This work is described in detail in Appendix A, but a summary is provided in Table 6. An important point about the case records is that they also contain uncoded free text which provides otherwise unused information on the circumstances of the accidents.

The first column in Table 6 lists the locations for which case records were examined. In fact, all of the locations in Table 5 are listed except the creche/nursery category which, because it is usually indoor, is not a focus of this study. The second column gives the number of records examined against each location. Experience revealed that these records needed to be considered against certain criteria which resulted in some being screened out of the tally. It has to be said that screening is not ever something that can be done without the introduction of value judgements. In this case the judgements used were that an age cutoff of 16 years would apply, that is, persons of 17 years and above would be removed from the record (since play equipment nowadays is not usually designed for young or mature adults); that accidents involving homemade equipment would not be included; that accidents which were misassigned to a particular location would be removed (or reassigned) as would those (few) cases where information was too sparse to be useful. The main effects of this were to reduce the tally of public playground cases by about 13%, and, more dramatically, to severely reduce the number of cases in ‘other leisure facilities,’ ‘other locations,’ and especially ‘country and woodland.’ Most country and woodland cases involved rope swings which appear mainly to have been homemade,

²¹ The nature of the ‘other locations’ is described in Appendix A.

and for this reason were screened out. The other two locations included a fair number of indoor play venues and also some rope swings, both being screened out.

LASS location	No. of cases examined	No. after screening	No. not naming equipment	No. naming equipment	Scale factor	National estimate ^{d,k} _{,l}	Revised national estimate ^k _m
Public playground	1,652	1,440 ^a	586 ^b	854 ^c	19.53	16,700	21,200
School playground	1,085	1,069 ^e	1,034 ^f	35	7x19.53	4,800	6,100
Public house etc.	102	55 ^g	0	55	19.53	1,100	1,400
Other leisure facility	100	28	0	28	19.53	500 ^h	600
Parkland	477	435 ⁱ	0	435	19.53	8,500	10,800
Country and woodland	71	4 ^j	0	4	19.53	100	100
Other locations	112	62	0	62	19.53	1,200	1,500
Unknown location	592	450	0	450	19.53	8,800	-
Total						41,700	41,700

Table 6: Summary of playground cases resulting in A & E attendance in 1998 by location. The figures in the two right hand columns do not include accidents occurring on playgrounds unless a piece of equipment (slide, swing, climbing frame, seesaw, rope swing or roundabout) has been named.

^aCases were screened out where other locations were mentioned, where victims were above 16 years of age, and where case descriptions were inadequate to make judgements.

^{b,c}The cases after screening are split into those naming equipment and those not naming equipment. The latter include 200 cases involving non play equipment items presumably brought onto the playground or arriving there by some other means, 240 cases with no particular connection with playgrounds such as playing football or some other sport, and 146 cases of playground activity resulting in an accident but which did not entail equipment. See Appendix A for details.

^dEquipment-related cases only.

^eScreening primarily on a locational basis.

^fMost school playground accidents involve slips and trips, collisions, behavioural factors and informal sports.

^gOne third to one half of the public house cases probably occurred on indoor play facilities.

^hIndoor and adventure play are not included.

ⁱOf the 477 cases examined, 15 were screened out because they appeared to have occurred elsewhere (eg in a private garden) or involved causes irrelevant to play. A further 27 cases involving rope swings were also taken out as these appeared to be DIY facilities.

^jMost cases involve home-made rope swings and have been screened out.

^kAll numbers in this column are given to the nearest 100. Rounding errors may be present.

^lIn theory a small upward correction could be made to these numbers as there are some equipment-related injuries which occur on equipment outside the range of that considered (except for public and school playgrounds in which all equipment was considered). However, the correction is thought to be less than 2% and has been ignored.

^mIn this column the cases in the 'unknown location' category have been reapportioned to the other locations.

After screening, the remaining cases were divided into those naming and those not naming a piece of play equipment. In this respect differences between locations are quite marked. In school

playgrounds most accidents take the form of trips and collisions, whereas in public playgrounds, because of the greater wealth of equipment, equipment features more strongly in the case records. For the other locations in the Table, all cases necessarily refer to a piece of equipment because this is how the records were extracted from the LASS database (unlike public playgrounds and school playgrounds).

Having arrived at the number of cases naming play equipment, the national estimate of A & E cases can be arrived at by application of the appropriate scale factor. For all locations together the number of equipment-related A & E attendances arising from playgrounds appears to have been in the region of 41,700 for 1998.²² It comes as no surprise that this number is dominated by public playgrounds and parks where most play of this kind occurs. There remains a substantial number, 8,800, of cases assigned to the category ‘unknown location.’ It is probably a reasonable approximation to reapportion these cases to the known locational categories according to the numbers of cases logged against them, and this has been done in the final column of Table 6.

2.2 FATALITIES IN PLAYGROUNDS

Currently the DTI CSU does not keep a fatal accident database for leisure activities, and the HSE has provided this information instead. As can be seen from Table 7, there have been 14 fatalities assigned to UK playgrounds during the 13 year period from 1986/87 to 1998/99. Also listed are the numbers of major injuries reported to the HSE each year. Although the fatality data are likely to be complete, the major injury data are known to be underestimates because of underreporting. HSE’s definition of major injury has also changed during the period, and this along with other collectional factors, means that little can be inferred from comparisons between one year and another. There is also no universally-agreed definition of ‘serious injury.’ HSE’s definition includes most fractures, amputations, certain eye injuries, injuries resulting from burns and electric shock, loss of consciousness from lack of oxygen, and any injury resulting in hospital admission for more than 24 hours.

Year	Fatal	Major	Year	Fatal	Major
1986/87	1	3,809	1993/94	1	1,037
1987/88	3	2,445	1994/95	2	692
1988/89	0	2,465	1995/96	0	720
1989/90	1	1,619	1996/97	0	2,379
1990/91	3	1,326	1997/98	1	1,773
1991/92	1	1,493	1998/99	0	^a
1992/93	1	1,002			

Table 7: Fatalities and ‘major’ injuries recorded in UK playgrounds for children of 1 to 15 years, 1986/87 to 1998/99 (HSE data).

^a not available at time of writing.

Descriptions of the fatal accidents assigned to playgrounds since 1986/87 have been provided by the HSE. Of the fourteen descriptions given, nine cases occurred on school premises and five on public playgrounds. Of the cases occurring on school premises, none appears to be assignable to either play equipment or the type of play usually associated with playgrounds. Three cases involved motor vehicles or vans in the playground, one a fall from a tree, two were falls from the

²² It is legitimate to ask why this number, 41,700, is less than the 53,600 reported in Tables 4 and 5. This is because Table 6 excludes most rope swing cases, indoor play, adventure play, and persons of 17 years or more.

school roof (out of normal school hours), and one involved the collapse of a brick pier. The other two school cases involved trips and falls but not from a height, and both of these fatalities followed medical complications.

Of the five cases in public playgrounds, three involved falls from swings. One of these appears to have occurred at night and also entailed behavioural factors. The other two involved falls onto concrete. Of the remaining two cases, one involved a splinter from a wooden slide runout which punctured an artery, and the other a fall from a playground service vehicle.

Overall, therefore, it appears that for the 13 year period considered, three or four cases might be assigned legitimately to the kind of play considered in this report.²³ This is equivalent to one fatality every three or four years.

2.3 AN OVERVIEW OF WHERE AND HOW MANY

The analysis in the previous section leads to the conclusion that there is currently a fatality in a UK playground once every three or four years on average. In terms of injuries (as defined by attendances at A & E departments), the annual total of equipment related cases for 1998 is estimated as 41,700 with no convincing evidence of a trend over the decade.²⁴ As reported in Table 6, public playgrounds account for most of these cases (21,200), followed by parks (10,800) and schools (6,100) with miscellaneous locations including public houses, general leisure facilities, and the countryside accounting for the bulk of the remainder.

There is also the matter of injuries occurring on playgrounds but which do not involve fixed equipment. This is more difficult to deal with because it is necessary to decide what one wants to include. Should all cases originating on the playground be counted for instance, even if they involve activities like playing football or fighting? For public playgrounds (see Table 6), compared with the 854 cases examined which named playground equipment, 586 cases did not. However, as described in section 3.2.1 and Appendix A, by using the free text accident descriptions in the individual case records, 440 of the latter 586 cases have been judged to have nothing in particular to do with playgrounds and could have occurred anywhere. This suggests that if you want to include legitimate play²⁵ but non-equipment related non-fatal cases in the totals, then you need to multiply the above numbers by 1.17, and if you want to include absolutely everything happening on a playground, then you should multiply by 1.69. This would lead to totals of either 49,000 cases or 70,000 cases depending on one's preference as to what to include. However, this assumes that the ratio of the various kinds of cases in public playgrounds is mirrored in other playgrounds. This is a crude assumption and is certainly untrue of school playgrounds where non-equipment related cases are far more frequent.

As noted earlier, A & E attendances are just one of several outlets for injured children. Some may visit their GP, others may attend specialist medical centres, and some may be treated at home or not treated at all. The relative numbers are not accurately known, although a study of

²³ The school cases have been excluded and so has the service vehicle case because it does not directly involve the safety of play equipment although there is clearly an indirect link which should be noted.

²⁴ Based on data in section 3.2.1, it is estimated that about 9% of A & E attendances result in hospital admission, usually for a period of between one and two days.

²⁵ 'Legitimate' play here implies play related to the purposes for which the playground is primarily intended, although other definitions could be used.

adults (16 to 45 years of age) injured in sports suggested that for every case generating an A & E attendance there are 2.3 others leading to visits to either family doctors or other practitioners (eg. physiotherapists, professions allied to medicine, and alternative practitioners), and about 10 times as many cases which are not treated professionally or not treated at all.^{26, 27} Were the same true for children injured in playgrounds, it would suggest that the 41,700 equipment related A & E attendances might generate a further 97,300 professionally treated cases, or 139,000 cases in all. However, the type of injury involved in these other cases is likely, on average, to be less serious. As for the large tail of essentially home-treated or untreated injuries, these must be presumed to be less serious still, and perhaps may be considered as constituting part of the normal background of bumps and scrapes of everyday life.

	Fatalities ^c	Hospital admissions ^d	A & E attendances ^e	A & E plus other medically-treated ^f	Non-medically treated cases ^g
Equipment-related	<u>0.3</u>	3,600	<u>41,700</u>	140,000	~0.4 million
Equipment-related plus non-equipment related ^a	-	4,200	49,000	160,000	~0.5 million
Equipment-related plus non-equipment related ^b	-	6,000	70,000 (~200,000)	230,000 (~660,000)	~0.7 million (~2. million)

Table 8: Estimated numbers of annual cases based on 1998 data except for the fatality estimate which is based on experience over the last thirteen years. Underlined data are primary data and therefore the most reliable. Excluding fatalities, uncertainty increases as you move away from the base figure of 41,700 A & E attendances. Data in parentheses include an allowance for accidents occurring on school playgrounds, but which are unrelated to conventional fixed equipment play activities. Injury severity declines steeply as you move from the left to the right side of the Table.

^aThese data include cases which are thought to involve genuine playground play.

^bThese data include anything that happens on a playground including games of football, cycling, and many things which could equally happen elsewhere.

^cPlayground fatalities are very rare, the numbers are correspondingly small, and only an overall rate can be given.

^dBased on 8.6% of A & E attendances and rounded to the nearest 100 cases.

^eThese are the base data from which the non-fatal injury data in the rest of the Table are calculated.

^fEstimates, rounded to the nearest 10,000, of A & E attendances plus visits to GPs, other medical practitioners, professionals allied to medicine, and alternative practitioners.

^gSpeculative estimates, to the nearest 100,000, of non-medically treated playground injuries.

These figures are summarised in Table 8, in which injury severity diminishes steeply as one moves from the left to the right. The base figures, and most reliable, are underlined. Other figures are derived using additional scale factors as described in the text and are therefore more speculative, considerably so in some cases. One point which is clearly illustrated by this Table is the crucial importance which should be attached to defining precisely what is meant when talking about 'playground accidents.' Often there is uncertainty about what the real number is. Clearly this depends dramatically upon what is in the beholder's mind when s/he talks about accidents.

²⁶ Sports Council report by J. P. Nicholl, P. Coleman and B. T. Williams, 'A national study of the epidemiology of exercise-related injury and illness,' 1991. ISBN 1 872158 71 4.

²⁷ J. D. Langley, D. Chalmers and B. Collins, 'Unintentional injuries to school students,' J. Paediatr. Child Health, 26, 323-328, 1990 report a ratio of 20 visits to GPs and A&Es per hospital admission in New Zealand.

3. TYPES OF INJURIES AND CAUSAL FACTORS

Summary of Main Points from this Chapter

- In the UK, playground fatalities are so rare that patterns of causality cannot be reliably established. Data from other countries show one of the more frequent causes to be strangulation, often resulting from the use of items brought onto the playground by children. Other causes include falls, collisions, asphyxiation, piercing wounds and maintenance vehicles.
- Large numbers of accidents on playgrounds have little or nothing to do with the fixed equipment per se. Many involve items brought onto the playground, ranging from baby buggies to yo yos, or activities that are not strictly part of the playground's intent, such as playing football or messing with animals.
- A further substantial number of cases, which do involve the fixed equipment, also involve behavioural elements. These 'behaviours' range from wearing roller blades while on equipment to walking in the path of a moving swing. Where the dividing line is drawn between reasonable and unreasonable behaviour is a matter of debate.
- The UK data show that, unsurprisingly, the types of accidents associated with climbing equipment are mainly falls, whereas for moving equipment, such as swings and roundabouts, being struck is also important. Being struck and behavioural factors are especially important for seesaws.
- In terms of injury severity, the majority of playground accidents result in not more than cuts, abrasions and bruises and patients are treated and released. Of the roughly 9% of A & E cases who do become inpatients, few are detained for longer than one overnight stay.
- Regarding falls onto the playground surface specifically, about 40% of these cases which report to accident and emergency departments involve fractures, mainly of the upper limbs and extremities. There is no evidence in the UK data reported in this Chapter which indicates softer surfaces to present a lower risk of fracture than harder surfaces. Various explanations as to why this might be are advanced.

Chapter 2 of this report was concerned with establishing a plausibly reliable estimate of the number of A & E attendances and fatalities resulting from playground accidents, particularly those involving fixed play equipment, and estimates of the numbers of other kinds of accidents. This Chapter is concerned with the types of injuries incurred, the circumstances giving rise to them, and whatever can be gleaned from the DTI LASS and HSE databases about causal factors.

3.1 FATALITIES

With cases in the UK being so rare, roughly one every three or four years, it is not possible from a statistical perspective to draw any firm conclusions on aetiology. If one considers also cases from other western industrial countries with similar types of provision, causes can be seen to be disparate, complex, and are often one-offs. Thus, deaths in playgrounds may result from strangulation (e.g. by being caught in rope swings, or clothing drawstrings), falls, collisions, asphyxiation (e.g. by burial in sand), piercing wounds, and maintenance activities.^{7, 28, 29, 30, 31} It is reported that for strangulation cases in the USA, which account for almost half of playground deaths, a significant proportion involve ropes or chains brought on to the site by children, and which were not an integral component of the equipment.³²

3.2 NON-FATAL INJURIES

Numerically public playgrounds constitute the most important of the playground locations in terms of accidents and the analysis which follows is based on this sector. As recorded in Table 6, of the 1,440 public playground LASS cases remaining after screening, 586 did not name fixed equipment and 854 did. *Prima facie*, this suggests that about 40% of accidents on public playgrounds were unassociated with the equipment. However, this percentage is highly dependent on subjective interpretation. For one thing, the fact that equipment was named in 854 cases does not necessarily mean it is necessarily responsible in a causal sense for the accident. Likewise, the 586 cases (see Appendix A for details) involved 200 cases in which other items, ranging from baby buggies to yo yos, were implicated, and 240 further cases in which activities not related specifically to the kind of play for which playgrounds are designed, such as playing football or being bitten by a dog, were mentioned. This suggests that the actual number of non-equipment cases on the playground which did not involve an unrelated product or activity is in the region of 146. Examination of these cases indicates that approximately 60 % were due to trips or falls on the same level, 20 % to collisions with other persons or objects, and the remaining 20 % to a miscellany of causes as described in Appendix A.

Of greatest interest to most readers will be the 854 cases naming conventional play equipment. Table 9 summarises some of the results of their analysis. This Table shows the distribution of most of the 854 cases by equipment type. Other cases not shown in the Table are 16 associated with firemen's poles, 45 with other equipment types, and 29 that did not specify the equipment type. In this Table it can be seen that most cases are associated with climbing frames and swings but in the absence of information on usage little can be deduced about the relative riskiness of these items.

²⁸ D. A. Drago, F. K. Winston and S. P. Baker, 'Clothing drawstring entrapment in playground slides and school buses,' *Arch. Pediatr. Adolesc. Med.*, 151, 72-77, 1997.

²⁹ J. Petruk, 'Fatal asphyxiations in children involving drawstrings on clothing,' *Canadian Med. Assoc. J.*, 155 (10), 1417-1419, 1996.

³⁰ M. G. Mack, S. Hudson and D. Thompson, 'A descriptive analysis of children's playground injuries in the United States 1990-4,' *Injury Prevention*, 3, 100-103, 1997.

³¹ D. K. Tinsworth, 'Playground injuries – 1990 vs today,' *Proceedings of 'Playground Safety,' Penn State, 1999*, edited by M. L. Christiansen. ISBN 0 960342 1 6.

³² C. Pollack-Nelson, 'Home playground equipment fatalities,' 127-131, *Proceedings of 'Playground Safety,' Penn State, 1995*, 65-72, edited by M. L. Christiansen. ISBN 0 9650342 0 8.

Equipment type	Total cases	Behavioural factors ³³	Fall from a height	Hit equipment or other object	Other cause	Unknown	Cases not relevant	Total of relevant cases
Slides	172	46 (28%)	70 (42)	35 (21)	9 (5)	6 (4)	6	166 (100)
Climbing frames	256	27 (11)	190 (75)	25 (10)	8 (3)	2 (1)	4	252 (100)
Swings	229	95 (43)	106 (48)	4 (2)	14 (6)	-	10	219 (100)
Seesaws	60	15 (25)	10 (17)	25 (42)	9 (15)	-	1	59 (100)
Roundabouts	46	16 (35)	16 (35)	6 (13)	7 (15)	1 (2)	-	46 (100)

Table 9: Summary of factors contributing to equipment related cases for the five most common types of equipment. Figures in brackets are percentages and add up along the rows.

It is emphasised that Table 9 as presented contains a number of value judgements. By way of example, 46 of the 172 slide cases have been attributed, partially at least, to behavioural factors. These constitute cases, for example, where a child ran into a slide, was pushed from a slide, was climbing the chute, playing at night, wearing roller blades *et cetera*. It is clearly a matter of opinion which, if any, of these types of factor, should result in an accident being ascribed to behaviour rather than to an item of equipment. Some readers may wish, therefore, to reapportion these cases amongst the other contributory factors listed in the Table. A particular case is that of swings, in which 39 cases of being hit by a swing and 25 of jumping on or off, have been included in the behavioural factors column. The view, admittedly ‘clinical,’ has been taken here that such cases are at least partially attributable to lack of vigilance or care by a child or guardian rather than a fault in equipment design and layout, although the latter of course cannot be ruled out as contributory factors. An alternative approach would be, for example, to assign the 39 cases to the column ‘hit equipment or other object.’

So, bearing these caveats in mind, Table 9 shows that the types of accidents involved with climbing equipment largely relate to falls from a height, and while those involving slides, swings and roundabouts also commonly involve falls from height, there is a greater prominence of other factors such as behaviour or being struck. For seesaws in particular, being struck and behavioural factors dominate. None of this is in the least counterintuitive. It might reasonably have been supposed that climbing would involve a risk of falling, and that moving equipment (swings, roundabouts and seesaws) would open the door to being struck, whether or not this is ascribed to either lack of attention by the user or some design feature.

Another important issue is injury severity. Severity is not easily measured and the main indicators in the LASS data base are the brief descriptions of the body part affected and injury type, whether or not there is a referral, and the number, if any, of in-patient days. The majority of playground cases involve not more than cuts, abrasions and bruises and are treated and released. Table 10 shows that for the five main equipment types, 9% of the 763 cases became inpatients, with few being detained for much more than a day. On the other hand, 221 cases (29%) involved

³³ What is considered as reasonable behaviour depends on one’s point of view. For those with a liberal interpretation of equipment use it may be preferred that some, even most, of these cases be assigned to the other columns.

fractures, most³⁴ of which would be classified as ‘serious’ injuries according to the HSE’s definition, though not necessarily according to other definitions. Of these 221 fracture cases, 90% involved the upper limb including the hand and fingers.

Equipment type	Total cases	Fractures	Main body part	Concussion	No. of inpatients	Mean IPD ^a
Slides	172	44	upper limb	2	9	1.8
Climbing frames	256	99	upper limb	9	33	2.7 ^b
Swings	229	60	upper limb	3	17	1.6
Seesaws	60	9	upper limb	0	3	3.3 ^c
Roundabouts	46	9	upper and lower limb	0	4	13. ^d

Table 10: Measures of severity of public playground injuries. IPD = inpatient-days.

^aIn-patient days

^bIncludes one case of 28 days without which mean IPD is 1.9

^cIncludes one case of 7 days without which mean IPD is 1.5.

^dIncludes one case of 45 days and one case of 5 days, both involving lower limb injuries. Without these cases the mean IPD is 1.0.

Given the enduring interest in the relationship between under-surfacing and the severity of cases following falls from equipment, the numbers of cases involving or not involving a fracture versus surface type is summarised in Table 11. These data can only be partially interpreted and care is necessary in drawing conclusions. One can say that overall, of the falls recorded here, about 40% resulted in fractures. We have no knowledge of the number of falls not resulting in attendances at A & E departments. Interestingly, the percentage of falls resulting in fractures is somewhat lower for hard surfaces such as concrete and tarmac than for natural surfaces such as grass/earth, and even proprietary impact absorbing surfaces such as sand, bark and woodchip, and rubber. However, not too much can be read into this. Various explanations are possible, for example, harder surfacing may be associated with equipment with lower fall heights. Alternatively, a behavioral explanation would be that children modify their play when they believe that the environment is safer. Yet again, a biomechanical explanation would be that impact absorbing surfaces are not designed to reduce the risk of the commonly occurring upper limb fractures and may be less effective in this respect than has been hoped. The data available here are insufficient to pursue this line of enquiry further.

Surface	Concrete	Tarmac	Sand	Bark/chip	Grass/earth	Rubber	Other	Unknown	Total
Fracture	7	8	4	33	12	26	2	66	158
No fracture	25	16	2	32	23	27	11	73	209
Unknown	1	-	-	-	-	2	-	4	7
Total	33	24	6	65	35	55	13	143	374

Table 11: Analysis of public playground fall consequences (measured in terms of whether or not a fracture was incurred) for swings, climbing frames and slides combined versus surface type.

³⁴ The HSE definition of serious injury excludes fractures of the hand and foot. There are about 16 such cases in this data set.

4. ASSESSING RISKS

Summary of Main Points from this Chapter

- Comparison with playground accident statistics from some other countries suggests that the UK record is relatively favourable, particularly in so far as fatalities are concerned which are very rare here.
- Within the UK, there are about 500 to 600 child fatalities from accidental causes each year, whereas the average for playgrounds in the UK is one case every three or four years. Also, UK playground accidents involving fixed equipment are estimated to account for slightly less than 2% of childhood hospital accident and emergency attendances resulting from home and leisure accidents of all kinds.
- Fractures are often regarded as the most serious of the commonly occurring injuries in playgrounds. However, skeletal fractures, which are immensely common in childhood, are not universally regarded as 'serious.'
- Calculations indicate that the risk of injury associated with using playground equipment is quite modest compared with that associated with many popular sports, such as soccer and netball, in which children are encouraged to participate for health reasons.
- A review of international studies of playground risk factors finds that equipment height, irrespective of undersurface, is the strongest candidate (with the exception of body orientation in impacts following falls – see next point) and various authors have suggested height restrictions on equipment, most commonly that it should not exceed 1.5 metres. This raises important questions about 'play value' which are discussed later in this report.
- From a statistical perspective, a very important risk factor for injury following playground falls appears to be body orientation on impact. Simply put, if upper limbs strike the ground first rather than lower limbs, a fracture is much more likely to result. It is of course natural to extend the arms in a fall as a self-protective measure, and this could partially explain the 'height effect,' in that children falling from greater heights have fractionally more time to extend their arms and their bodies have longer to invert. Because body orientation on impact is not a factor which playground designers can have much influence upon, it appears that the chance of injury following a fall remains in substantial part a matter of fortune.
- Epidemiological research on under-surfacing as a risk factor gives mixed results. Some studies find benefits of some surface types in terms of reduced injury risk and others do not. Overall, considering the strengths and limitations of the various studies and the inherent difficulties in carrying them out, it is perhaps fairest to conclude from what is now known that compliant surfaces may have some beneficial effect under certain conditions. However, the associated risk

factor does not appear to be large and therefore requires care in interpretation. Nonetheless, it could still, in theory, have a significant effect on injury numbers because exposure to this factor is high.

- New biomechanical research on falls strengthens the idea that a crucial determinant of injury risk from falls is the body part impacting the surface. One group of authors finds that falls onto outstretched arms result in two types of impulse, only one of which is attenuated by padded surfaces. To combat the second kind, restrictions on equipment height (they suggest a 1.5 metre limit) are also necessary.
- Studies of the impact performance of different surfaces under different environmental conditions using both 'peak g' and 'HIC' measures raise a number of questions. For one thing, these measures were not well correlated and are clearly not inter-changeable. Secondly, both measures showed that the surface types tested (wood chips, sand, grass, rubber etc.) all met the criteria under all test conditions employed, except for wet, frozen sand which performed 'badly' on peak g but 'well' on HIC. Whatever, it is noted that the scientific relationship both between these measures and with the risk of injury to falling bodies, is subject to a chain of unquantified uncertainties.
- Studies which probe in great detail the circumstances of accidents point to an overwhelming importance of behavioural factors in many playground accidents.

An extended review of published and unpublished research on playground safety was reported as part of the 1989 study.⁷ Here, additional research undertaken during the 1990s is examined. This research comes from different domains and hence reflects different professional interests and assumed priorities. For example, some authors are more concerned with the perceived benefits of play, while others are more interested in play as a source of injuries to children. Rather few papers attempt to bridge this divide although for play providers the need to try to do this is paramount. In this Chapter the emphasis is upon risk assessment and safety, whereas Chapter 5 looks at the other side of the coin, in particular, concepts of the value of play and studies relating to the benefits of play. Bringing these together is the task of (risk) management, as described in Chapters 7 and 8.

4.1 STUDIES OF PERSPECTIVE

4.1.1 International Data

At some stage it is important to place playground injuries in perspective, since numbers of cases by themselves say far from everything and may even create a false impression. Perspective can be achieved in various ways. One is to compare data from different geographical areas. Table 12 provides some information of this kind, by comparing the results from the present study, in the form of injury rates per 100,000 child population, with results reported from other countries. From this Table it can be seen that the UK record is actually relatively favourable. This is particularly so in the case of playground fatalities which are very infrequent here. In the USA

there are about 15 to 17 such cases per annum.^{30, 31, 35} Even New Zealand with its small population is reported as having about one case per annum³⁶ compared with less than one on average in the UK with its roughly ten times larger child population.

In respect of A & E attendances, the Canadian data in Table 12, based on a study in Kingston, Ontario,³⁷ are thought to be much higher than for elsewhere because of a lack of differentiation between schools and school playgrounds and between school playgrounds and playground equipment. As discussed in Chapter 2, these are very different scenarios.

Country	Period	Fatality rate per 100,000 population	Rate of hospital admissions per 100,000 population	Rate of A & E attendances per 100,000 population	Source
USA	1990-94	0.03 ^b		382 ^a	Mack et al. ³⁰
USA	1998			392	Tinsworth ³¹
New Zealand	mid-90s	0.15 ^d	137	930 ^c	Chalmers et al. ³⁶
Canada	1994			~2,000 to 4,400 ^e	Bienefeld et al. ³⁷
UK	1990s	0.002 ^f	28 ^f	320 ^f	this study
UK	1980s	~0.01 ^g	~70 ^g	~500 ^g	King and Ball ⁷

Table 12: Some annual playground injury rates as reported in selected studies.

^aFor 0-14 year children. Child population of 55 million. 70% of cases on public playgrounds.

^bMack et al. report an average of 17 playground fatalities each year in the USA. 67% are said to occur on home playgrounds. Deaths result from strangulation (ropes, clothing etc.), falls, entrapment, collisions, being struck, and face burial in sand.

^cFor 0-15 year children and a child population of 0.8 million.

^dBased on one playground fatality per year.

^eFor 5-14 year olds and including public playgrounds, day care and schools. Figure varies according to age and gender.

^fFor 0-16 year children and a child population of 13 million. Equipment-related cases only.

^gBased on the earlier review.⁷

In a review by Mazurek³⁸ of the situation in the USA, the annual death toll of children (0 to 14 years) from accidents is reported as between 8,000 and 10,000. Leading causes are given as foreign body aspiration (~250 cases per year), motor vehicle accidents, cycle accidents (~340 per year), sports injuries, firearm incidents (~5,000 per year), and child abuse. As noted above, the annual number of cases associated with playgrounds is of the order of fifteen to seventeen. Mazurek goes on to discuss the incidence of minor injuries, which are defined as those with an Injury Severity score (ISS) of less than nine. It is of interest to note that ISS scores of less than nine include abrasions, lacerations *and* long bone fractures.

³⁵ M. K. Swartz, 'Playground safety,' J. Pediatric Health Care, 6 (3), 161-162, 1992.

³⁶ D. J. Chalmers, S. W. Marshall, J. D. Langley, M. J. Evans, C. R. Brunton, A-M. Kelly and A. F. Pickering, 'Height and surfacing as risk factors for injury in falls from playground equipment: a case-control study,' Injury Prevention, 2, 98-104, 1996.

³⁷ M. Bienefeld, W. Pickett and P. A. Carr, 'A descriptive study of childhood injuries in Kingston, Ontario, using data from a computerized injury surveillance system,' Health Canada – Chronic Diseases in Canada, 17 (1), 1996.

³⁸ A. J. Mazurek, 'Epidemiology of pediatric injury,' J. Accident Emergency Medicine, 11, 9-16, 1994.

An alternative perspective is provided by Lyons et al.³⁹ who examined the incidence of children's fractures (0-14 years) from all causes in a part of South Wales. Fractures, of course, are commonly considered as figuring among the more serious outcomes of playground accidents, although from a medical perspective they may be rated less severely.⁴⁰ In the current study they account for about one quarter of playground equipment-related A & E attendances, with an annual incidence rate of ~80 per 100,000. In marked contrast, however, Lyons et al. report an all cause fracture incidence rate of 3,600 per 100,000 children in their study. This rate is 45 times higher than that estimated here for playground equipment-related cases. It also informs us that children's fractures overall are exceedingly common, with about 3% of children experiencing a fracture each year (alternatively, about half of our children can expect to have had a fracture by the time they are 15 years old!).

Lyons et al. describe the places where fractures occur as follows: transport areas (15%); homes (30%); schools (15%); sports areas (17%); parks (9%); countryside (4%); other (10%). In this classification playgrounds are largely subsumed into parks and schools, accounting for, it appears, about 10% of all cases, which would therefore suggest a fracture incidence rate for playgrounds of 360 per 100,000, considerably higher than the rate of 80 arrived at from this study. This difference is probably attributable to the fact that, as described in section 2.1.3 and Appendix A, a lot of things occur on playgrounds which have little to do with play or playground equipment. Also of note is that sports activities, especially ball sports and wheel sports, account for 35% of all fractures for these children.

Bienefeld et al.³⁷ likewise report hospital attendance rates for children in the Kingston, Ontario region of Canada. Based on A & E attendances, the overall injury rate for children for all causes was found to be 17,300 per 100,000, which is broadly consistent with the rate reported by Lyons et al. for South Wales (bearing in mind that fractures can account for about 20 to 30% of A & E attendances). Bienefeld et al. attribute over one quarter of these injuries to playgrounds and being at school but, as noted above, differentiation between locations and activities is unclear and it is difficult to interpret the data at this level of disaggregation.

4.1.2 UK Data

Data on the incidence of child fatalities in England and Wales from all causes are summarised in Table 13 and Figure 4. This Table shows that there are 500 to 600 cases each year, with the main causes being transport related accidents (42%), submersion including drowning (17%), homicide and violence (17%), and fire and flames (9%). The category of accidental falls accounts for 4% of all cases. These falls occur from all kinds of structures and natural objects and falls from playground equipment are necessarily seldom included because of their rarity. As has been seen (section 2.2), the rate of playground equipment-related fatalities in the UK averages out at about one per three or four years, not all of which are attributable to falls.

³⁹ R. A. Lyons, A. M. Delahunty, D. Kraus, M. Heaven, M. McCabe, H. Allen and P. Nash, 'Children's fractures: a population-based study,' *Injury Prevention*, 5, 129-132, 1999.

⁴⁰ Overall, skeletal trauma accounts for 10 to 15% of childhood injuries, and these commence with birth. The developing human skeleton is also subject to a large variety of inherited and acquired diseases affecting the ability to form normal skeletal morphology, some of which have a detrimental effect on the growth of bones which may predispose to skeletal injury. However, bone healing is relatively rapid in childhood (J. A. Ogden, 'The uniqueness of growing bones,' 1-86, In: 'Fractures in children,' ed. C. Rockwood, 1991. ISBN 0 397 51152 3.)

So far as non-fatal injuries are concerned, the most reliable comparator available is the rate of A & E attendance as reported by the DTI. Table 14 provides a summary for 0 to 14 year olds. Of the 2.25 million A & E attendances in 1998 attributed to home and leisure accidents, slightly less than 2% can be ascribed to playground equipment related injuries.

Another way of comparing risks of different activities is to estimate the risk of injury per unit time of exposure. For non-fatal injuries, risks are usually calculated per 100,000 hours of exposure. Table 15 makes some comparisons of this kind for a number of activities including playing in a

Age group/Cause	< 1 year	1 - 4	5 - 9	10 - 14	Total	ICD E Code
Transport	7 (7)	42 (50)	80 (77)	114 (102)	243 (236)	800 - 848
Accidental poisoning	2 (-)	7 (8)	1 (2)	1 (7)	11 (17)	850 - 869
Medical misadventure	1 (3)	3 (3)	1 (1)	1 (1)	6 (8)	870 - 879
Accidental falls ^a	2 (3)	7 (14)	4 (6)	6 (5)	19 (28)	880 - 888
Fire and flames	3 (5)	26 (33)	7 (17)	4 (7)	40 (62)	890 - 899
Environmental factors	2 (-)	3 (-)	- (1)	1 (1)	6 (2)	900 - 909
Submersion and suffocation	18 (23)	42 (46)	15 (11)	18 (22)	93 (102)	910 - 915
Other causes ^b	4 (2)	12 (9)	8 (7)	9 (10)	33 (28)	916 - 928
Late effects	- (-)	1 (-)	- (-)	- (-)	1 (-)	929
Drugs	- (-)	1 (-)	- (1)	- (-)	1 (1)	930 - 949
Suicide	- (-)	- (-)	- (-)	7 (7)	7 (7)	950 - 959
Homicide	13 (20)	19 (28)	10 (4)	5 (7)	47 (59)	960 - 969
Other violence	11 (9)	13 (10)	6 (-)	15 (18)	45 (37)	970 - 999
Total	63 (72)	174 (201)	132 (127)	182 (187)	551 (587)	800 - 999

Table 13: Child fatalities by cause in England and Wales in 1994 (1993 data in parentheses).⁴¹

^aIncludes falls from buildings, stairways, cliffs etc.

^bIncludes accidents due to machinery, falling objects, hot substances, and electric current etc.

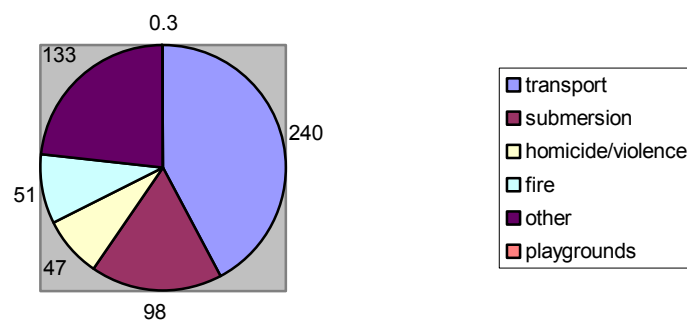


Figure 4: Distribution of causes of child fatalities in England and Wales (1993/1994 data).

⁴¹ Office of National Statistics, 'Mortality statistics – cause,' Series DH2, No. 21, HMSO, 1996.

Accidents by activity	Totals	By sub-activity
All HASS cases	1.03	
All LASS cases	1.22	
- shopping		0.01
- education		0.14
- sport (exc. education)		0.24
- play/hobby/leisure		0.38
(- play equipment related)		(0.042) ^a
- basic needs		0.07
- travelling		0.11
- other		0.27

Table 14: Distribution of home and leisure accidents (millions of A & E attendances) for 0 to 14 year old children in the UK in 1998.

^aBased on this study.

playground.⁴² Clearly, many assumptions are inherent in data of the kind presented in Table 15, and the numbers should be regarded as no more than estimates. In particular, the estimate of 5 per 100,000 for play is based on an earlier estimate of 29,000 A & E attendances as a result of public playground accidents, whereas the figure calculated for this report is 21,200 (from Table 6). On the other hand, the estimate is also based on an assumed average exposure of one hour per week per child which, in the absence of any UK data, is little more than a guess (although American data suggest children spend about 1 hour per day involved in outdoor sport and play⁴³). However, even though the estimate of 5 per 100,000 hours is uncertain, it is certainly quite modest compared with the risks of numerous other sports activities⁴⁴ in which young and old alike, for very good reasons, are encouraged to participate (Table 16).⁴⁵

4.2 STUDIES OF PLAYGROUND RISK FACTORS

A number of scientific studies have used statistical techniques to search for risk factors associated with playgrounds. The main potential risk factors investigated have been the height of falls (usually taken as maximum equipment height) and under-surfacing. Table 17 lists a number of such studies which are presented chronologically together with a few of the main findings as stated by the authors. These studies are described and commented upon below.

The first study in Table 17, by Sacks et al.,⁴⁶ was based upon a survey of playground hazards in 66 child care centres in Atlanta coupled with a retrospective review of medically attended injuries occurring on them during a one year period. Hazards were identified on the basis of judgement e.g. sharp edges, loose parts etc.. 528 equipment hazards were found and a further 156 non-equipment hazards such as tree stumps and broken glass. While the number of accidents during the year was small (~34), it appeared that there was a relationship between the numbers of

⁴² D. J. Ball, 'Risks and benefits of sports and exercise – looking ahead,' J Sports Exercise and Injury, 4, 174-182, 1998.

⁴³ A. Silvers. B. T. Florence, D. L. Rourke and R. J. Lorimor, 'How children spend their time: a sample survey for use in exposure and risk assessments,' Risk Analysis, 14 (6), 931-944, 1994.

⁴⁴ D. J. Ball, 'Risks and benefits of sports and exercise - assessing the risks,' J Sports Exercise and Injury, 4, 3-9, 1998.

⁴⁵ D. J. Ball, 'Risks and benefits of sports and exercise – gauging the benefits,' J Sports Exercise and Injury, 4, 74-79, 1998.

⁴⁶ J. J. Sacks, K. W. Holt, P. Holmgreen, L. S. Colwell and J. M. Brown, 'Playground hazards in Atlanta child care centers,' Amer. J. Public Health, 80 (8), 986-988, 1990.

hazards on a playground, as defined, and the numbers of injury cases. Regarding fall injuries from climbers, the number of cases also appears to increase with height of equipment, being, say, greater for equipment over 5 feet (1.5 m). However, since only 13 fall injuries involving climbers were recorded in all, there are rather few cases associated with each height band so the statistical uncertainty must be significant. Furthermore, the method was unable to account for exposure (i.e. numbers of children using equipment and for how long) which, inter alia, might conceivably be different for higher equipment, and the possibility exists of social factors acting as confounders.

Activity	Risk of occurrence per 100,000 hours of exposure		
	A & E attendance	Major injury	Over 3 day injury
Being at home (15 years and over) ^a	2	-	-
Being at home (less than 15 years) ^b	4	-	-
Playing in a playground ^c	5	-	-
At the fairground	20	0.06 ^d	-
Driving a car ^e	-	0.2	-
Riding on a motorcycle ^f	-	7	-
Riding a bicycle ^g	-	1	-
Working in a coal mine ^h	-	0.3	2.4
Working in construction ⁱ	-	0.2	1

Table 15: Comparative risks of injury per 100,000 hours of exposure to specified activities. Rates are estimated according to three definitions : A & E attendances, major injuries (as defined by HSE), and over 3 day injuries (as defined by HSE).⁴²

^aBased on 1.76 million attendances at A & E Departments in the UK as a result of home accidents by the 15+ age group in 1993. Assumes 2,000 hours of exposure per person per annum, and an exposed population of 46.2 million.

^bBased on 1.13 million attendances at A & E Departments by children under 15 in 1993. Assumes 2,500 hours of exposure per child per annum, and an exposed population of 11.7 million.

^cBased on 29,000 attendances at A & E Departments by children under 15 in 1993. Assumes 1 hour per week exposure, and an exposed population of 11.7 million.

^dBased on an average of 10,000 A & E attendances and 30 serious injuries per year in fairgrounds, an estimated 500 million rides, and an assumed 10 rides per hour.⁴⁷

^eBased on 40 major injuries per billion passenger km and an assumed average speed of 50 km per hour.⁴⁸

^fBased on 1400 major injuries per billion passenger km and an assumed average speed of 50 km per hour.⁴⁷

^gBased on 850 major injuries per billion passenger km and an assumed average speed of 15 km per hour.⁴⁷

^hBased on British Coal data reported by Ball and Roberts.⁴⁹

ⁱBased on health and safety at work statistics 1990-91⁵⁰ and 2000 hours per occupational year.

⁴⁷ N. J. Holloway and R. Williams, 'An assessment of risks at fairground rides,' HSE Report, 1990.

⁴⁸ Department of Transport, 'Road accidents Great Britain,' HMSO, London, 1994.

⁴⁹ D. J. Ball and L. E. J. Roberts, 'Risks of seven UK electricity generating options,' Energy and the Environment, 6, 283-335, 1995.

⁵⁰ Health & Safety Executive, Employment Gazette Occasional Supplement, No. 3, 1993.

Sporting activity	A & E attendance rate per 100,000 hours of participation
Rugby	290
Soccer	130
Hockey	90
Netball	80
Cricket	40
Basketball	40
Squash	40
Skiing	40
Athletics	20
Tennis	15
Badminton	14
Running/jogging	5
Golf	2
Bowls	1.5
Table tennis	1
Snooker	0.1

Table 16: Estimated risks of A & E attendance by sport for the age group of 16 years and above.⁴⁴

The second study listed, by Sosin et al.,⁵¹ examined 282 reports of childhood equipment-related falls in Utah school playgrounds. Surfaces onto which falls occurred included asphalt, concrete, grass, earth, rubber, sand and gravel. A survey of all school playgrounds recorded maximum fall height and undersurface against which the accident reports could be matched, but it was not possible to identify the specific item of equipment fallen from and hence the actual fall height, and presumably (and crucially) not the undersurface either if this were different in different areas of the playground. As an approximation, the authors devised a formula which generated a number representing the relative fall height for each playground. The study required several other non-trivial assumptions regarding accident circumstances and exposure, leading the authors to dispense with the calculation of statistical confidence intervals as an unwarranted sophistication. It is probably fair to say that this study should be regarded as exploratory.

Overall, Sosin et al. found the incidence⁵² of fall-related events to be 14 per 10,000 student-years, where a student-year is intended to reflect the playground exposure of one student during a school year. The incidence of fall injury was found to differ with under-surface type: sand was lowest (7), grass, rubber mats and gravel had similar rates (12 to 16), and concrete was highest (44). The results were similar for all injuries taken together, and the subset judged more severe (fractures and concussions).

The authors concluded that, so far as these results are concerned, grass is as good as any other surface. They did not seek to make further claims or recommendations in view of the many assumptions and uncertainties associated with their methodology.

⁵¹ D. M. Sosin, P. Keller, J. J. Sacks, M-J. Kresnow and P. C. van Dyck, 'Surface-specific fall injury rates on Utah school playgrounds,' American J Public Health, 83 (5), 733- 735, 1993.

⁵² Incidence is defined as the number of new cases occurring during a specified period of time related to the number of children exposed to the hazard.

Moving on to the third study in Table 17, by Mott et al.,⁵³ this examined 178 cases of playground accidents which were presented at a Cardiff A & E Department out of the study period total of 16,500 childhood attendances (0 to 14 years) for all causes. These descriptions were matched against inspections of individual playgrounds and, importantly, observations of numbers of children using playgrounds from which exposure could be estimated.⁵⁴ Most of the playgrounds in this study had either bark or concrete under-surfacing. In fact, there were 52 playgrounds with bark and 21 with concrete.

The exposure measurements suggested that the playgrounds with bark were more popular (perhaps because of location and modernity), and that 80% of the exposure was to bark rather than concrete-surfaced playgrounds. Of the 178 cases, 30 involved children falling from equipment onto concrete and 86 onto bark. Given that exposure to bark compared with concrete was estimated as 4:1 (80% to 20%), suggests that for every 30 cases on concrete there should have been ~120 on bark *if* other things were equal. So, the fact that only 86 cases were recorded suggested that maybe there was a protective factor associated with the bark playgrounds (though not necessarily the bark itself). However, the difference between 86 and 120 was found by the authors to be statistically insignificant, providing “a strong indication that there is not a difference in the total accident rate for the two surfaces.”⁵³

The authors went on to look at the proportion of specific injuries associated with the two surface types, finding in particular, 52 fractures to have occurred on bark compared with just 5 on concrete. These fractures resulted mainly from falls from climbing equipment and monkey bars, and involved the upper limb. The authors express some concern about the apparent injury rate on bark, though the quantity of data is by this stage of the analysis sparser and therefore less conclusive.

In 1995 Briss et al.⁵⁵ reported a nationwide survey of playground fall injuries in 1,740 US day care centres, where playground falls had previously been reported to account for 50% of day care centre injuries.⁵⁶ Injuries were defined as those requiring a visit to a physician, dentist or emergency department. Exposure was judged as equal to duration of attendance at the centres. Playground surfaces were classified as ‘potentially resilient’ if made of bark, rubber, gravel etc. and non-resilient if of asphalt, earth, concrete, grass etc..

Injury rates were found to increase with height of equipment from 0.15 (per 100,000 hours in day care; Confidence Interval 0.06-0.23) for equipment ≤ 1.2 metres, to 0.39 (CI 0.26-0.53) for equipment > 1.8 metres. Height was judged to be the most important risk factor. Injury rates appeared higher on potentially resilient surfaces than those defined as non-resilient. Optimal surfaces (defined on criteria based upon surface type, depth and equipment height) “resulted in no measurable benefit whatsoever.” By way of explanation, the authors point out the relative paucity of data on the least resilient surfaces (concrete and asphalt); the fact that resilient

⁵³ A. Mott, R. Evans, K. Rolfe, D. Potter, K. W. Kemp and J. R. Sibert, ‘Patterns of injury to children on public playgrounds,’ *Archives of Disease in Childhood*, 71, 328-330, 1994,

⁵⁴ Exposure assessment is an essential component of risk assessment but often the poor relation. This is partly because it is time consuming but perhaps also because it does not obviously present much of an intellectual challenge of the kind which researchers crave.

⁵⁵ P. A. Briss, J. J. Sacks, D. G. Adiss, M-J. Kresnow and J. O’Neil, ‘Injuries from falls on playgrounds,’ *Arch. Pediatr. Adolesc. Med.*, 149, 906-911, 1995.

⁵⁶ P. A. Briss, J. J. Sacks, D. G. Adiss, M-J. Kresnow and J. O’Neil, ‘A nationwide study of the risk of injury associated with day care center attendance,’ *Pediatrics*, 93 (3), 364-368, 1994.

surfaces designed to reduce the risk of head injuries may not be effective in dealing with commoner playground injuries (long bone fractures); that children may take more risks in apparently safer environments; and that there may be less supervision in playgrounds with apparently safer surfaces.

First named author and date of publication	Study characteristics	Size (no. of accidents)	Venue	Proposed effect of fall height	Proposed effect of under-surfacing	Other factors proposed as affecting injury rate
Sacks (1990)	Retrospective review of hazards and injuries	~34	Atlanta child care centres	Equipment > 1.5 m associated with more fall injuries	Not studied	
Sosin (1993)	Injury and exposure study	282	Utah schools	Not studied	Injury risk found to vary with surface type. Grass as effective as impact absorbing surfaces.	
Mott (1994)	Linked study of injury reports and exposure estimates	178	Cardiff public playgrounds	Not studied	No difference between bark and concrete on total injury rate	
Briss (1995)	Telephone survey	556	US day care centres	Height found to be 'most important' risk factor	No measurable benefit	Neither enforcement patterns nor safety regulations affected risk
Chalmers (1996)	Case control	300	Dunedin & Christchurch schools	3-fold increase in risk for falls > 2.5 m	2-fold increase in risk for non-IAS	
Mack (1997)	Case review	1,868	US sample	Qualitative evidence of a relationship	Higher percentage of severe head injuries and fractures on non-'suitable' surfaces	
Mott (1997)	Correlational study	136	Cardiff public playgrounds	Risk of injury increases with fall height	Rubber found less risky than bark than concrete	
Mowat (1998)	Matched case control	135	Kingston, Ontario public and school playgrounds	Not studied	Surfaces not complying with Canadian guidelines associated with higher risk	Inadequate hand and guard rails; play provider
Waltzman (1999)	Telephone survey	204	Boston, Mass. All climbing frames.	Not studied	Surfaces do not influence type or severity of injury	Adult supervision is ineffective
Laforest (2000)	Correlational study	930	Montreal, home, school and public playgrounds	Not studied	Grass found 1.7 times more risky than sand	
Macarthur (2000)	Case control	126	Toronto area public and school playgrounds	2-fold increase of severe injury risk for falls > 1.5 m	Not found to be a risk factor	

Table 17: Summary of studies investigating risk factors associated with playground injuries and some of the author's conclusions. See text for elaboration and comments.

Using a statistically more sophisticated approach, Chalmers et al.³⁶ sought to evaluate the effectiveness of the height and surfacing requirements of the New Zealand standard for playgrounds and equipment by means of a case control study in which 110 injury cases were compared with 190 controls. The controls had not required medical attention even though they had fallen from equipment. The study design was intended to overcome some of the problems of the earlier studies, such as methodological issues including not controlling for exposure, fall height, or other confounders. One shortcoming for UK readers is that for most of the study,

surfaces were classified (reasonably enough) according to the New Zealand Standard i.e. as impact absorbing (bark, sand and rubber) or non impact absorbing (concrete, asphalt, grass and earth), so denying scrutiny of more specific surfaces types. Of lesser importance, the study was of schools and early childhood education centres which may differ from their UK counterparts in terms of, for example, play equipment provision, type, and usage.⁵⁷

Statistical analysis of risk of injury versus fall height, while controlling for surface type and other confounders, produced an odds ratio⁵⁸ of 3 for falls over 2.5 metres. This suggested a 3-fold increase in risk of injury in falls above 2.5 m compared with falls of less than 2.5 m. Further analysis suggested this increased risk to be manifest mainly for fall heights of 1.5 metres or more. Regarding surfacing, a roughly 2-fold increase in risk was found for non-impact absorbing surfaces compared with either loose fill or synthetic material. The authors conclude that the greatest safety benefit, in terms of reduced hospital attendances, would be brought about by reducing the maximum permissible fall height from 2.5 m to, they suggest, 1.5 m. This is a recommendation which, of course, goes beyond purely technical risk assessment and into the domain of risk management. Risk management decisions (or choices) are necessarily affected by many other, non-technical, factors (see Chapter 7 for a discussion).

One very interesting matter which is apparent from the data presented is that, for the cases, the body part to hit the ground first was usually the upper extremity (63% for falls under 1 m and 73% for those over 1m). For the controls the proportion of upper extremity impacts is very much lower (14% below 1 m and 22% above), with most victims striking the surface first with a lower extremity. These differences are (statistically) highly significant and it would seem that the manner of the fall is a major determinant of injury risk irrespective of fall height or under-surface. Thus, if a child were to land, say, on an outstretched arm, a fracture would be much more likely to result than if the same child landed feet first. This, from a biomechanical perspective, appears logical. Furthermore, since body orientation on impact is not a factor which playground designers can have much influence upon, it appears that the risk of injury following a fall remains in substantial part a matter of fortune.

Mack et al.⁵⁹ extracted 1,868 case records of playground fall-to-surface injuries from the US NEISS⁶⁰ database. These were apportioned according to injury severity (judged in four categories: severe head injury, fracture, relatively minor and 'other') and surface type (judged as 'suitable' and 'unsuitable'). The distribution of cases according to severity was found to be less favourable on the surfaces classified as 'unsuitable,' although differences were not that marked. For example, taking the fracture group, for 'unsuitable' surfaces the derived percentage was 21 compared with 17 for 'suitable' surfaces. The authors note the possibility of reporting bias in

⁵⁷ J. D. Langley et al. (*J. Paediatr. Child Health*, 'Unintentional injuries to students at school,' 26, 323-328, 1990) report two fatalities and a significant number of hospitalisations due specifically to school playground equipment during the period 1977-86.

⁵⁸ The odds ratio is an important statistic in case control studies. It can be defined in several ways. One definition is the ratio of the odds of injury to non-injury among the exposed group to the odds of injury to non-injury among the unexposed group. See B. R. Kirkwood, 'Essentials of medical statistics,' Blackwell, ch. 24, 1994.

⁵⁹ M. G. Mack, D. Thompson and S. Hudson, 'An analysis of playground surface injuries,' *Research Quarterly for Exercise and Sport*, 68 (4), 368-372, 1997.

⁶⁰ The US National Electronic Injury Surveillance System (NEISS) is analogous to the DTI's HASS/LASS database.

these results and the lack in their study of any indicator of exposure to the different surface types.⁶¹

In 1997 Mott et al. published a further study of 136 playground accidents in Cardiff,⁶² this time including some with rubber surfaces and some with mixtures of surface types. As with their previous study, observation of playgrounds permitted a valuable estimate to be made of usage (exposure). Estimates were then made of total exposure to playgrounds with rubber, bark/rubber, bark, bark/tarmac or concrete/tarmac surfaces, and this in turn was compared with the proportion of the 136 cases occurring on each surface. The authors draw the conclusion that the relative risk for rubber is half that of bark and a fifth that of concrete. However, half of the 136 cases involved apparently lesser injuries such as cuts and abrasions, and there is a more modest 44 cases of more serious injuries (fractures are taken here as more serious in the absence of other data) to consider. These 44 cases are shared between the five surface classifications, with 34 being assigned to bark, which is as expected since bark accounted for most of the exposure. A problem is that the expected number of cases assigned to each of the other four surface types is very small (< 5 each) which leaves open the possibility of disturbances due to sampling variation. Thus, to state on this evidence that “We found that children are not protected against arm fractures by bark surfaces,” and that “Bark surfaces were not significantly more protective against arm fractures than concrete,” as the authors do, may be a trifle premature because this statement is based on a comparison with other surfaces for which very few cases were actually expected in the first place.⁶³

Mott et al.⁶² also report on the relative risks of slides, swings, climbing frames and monkey bars, all on bark surfaces, finding that the risk of a fall-related fracture from monkey bars was twice that from climbing frames and seven times that from swings and slides. This conclusion may also be somewhat speculative since, although the authors had found a useful way of estimating the exposure of children to different playground surfaces, the device used to assess exposure to individual types of equipment (based essentially on the number of items of that equipment on each playground) is probably a source of uncertainty. Climbing frames, for example, may accommodate more children at a time than other equipment types. Nonetheless, the authors believe on the strength of their study that “(monkey bars) should not be generally provided.” Apart from the science, this is a position which entrains some unrevealed value judgements, as does their expressed concern about the maximum fall height permitted by the new European Standard (see Chapter 7 for a discussion), the latter concern based on a proposed relationship between fall height and risk of fracture. Plausible though this relationship may be, the problems of sample size and exposure referred to earlier also apply.

⁶¹ Table A5 in Appendix A shows similar uncorrected (for exposure etc) data from the current study. The ratio of fracture to non-fracture injuries for the different surface types does not show a consistent pattern favouring surfaces such as sand, bark or rubber over other surfaces. Because of the numerous uncontrolled factors which could influence these results, not too much should be inferred from them – *either way*.

⁶² A. Mott, K. Rolfe, R. James, R. Evans, A. Kemp, F. Dunstan, K. Kemp and J. Sibert., ‘Safety of surfaces and equipment for children in playgrounds,’ *The Lancet*, 349, 1874-76, 1997.

⁶³ In a 1999 addendum (J R Sibert et al., *British Medical Journal*, 318, p1595, 1999) it is reported that by increasing the depth of bark in five Cardiff playgrounds from 300mm to 600mm, the injury rate per child was significantly reduced, but this effect appears to be largely attributable to events in just one of the five playgrounds.

Mowat et al.⁶⁴ studied 45 accidents (cases) involving injuries sustained on playgrounds and matched them with 90 controls (children who had been injured but not on playgrounds or who had presented for non-injury emergency medical care). Cases and controls were interviewed, and the playground where the injury occurred or the child most frequently played, surveyed. The authors were concerned with the influence of a variety of potential risk factors such as the adequacy of under-surfacing (as measured by compliance with N. American Standards), provision of handrails and guardrails on higher equipment, and so forth, on injury rates. They found the type and depth of surfacing materials to be the factor most strongly associated with the occurrence of injuries, although there is no differentiation in this regard between more and less serious injuries which are lumped together (fractures, for example, constituted one third of the cases).⁶⁵ The second strongest association was with the type of provider – cases were much more frequent in school playgrounds than on municipal playgrounds. This perhaps illustrates the potential for other factors to intervene in the analysis, for example, duration of exposure. Several other factors were associated with increased risk, though less strongly. These included adequacy of handrails and guardrails, and the presence of sharp edges and protrusions.

Waltzman et al.⁶⁶ identified 204 children from hospital records in Boston, Massachusetts who had been injured in falls from monkey bars. An analysis of these cases was conducted by telephone interview to determine location of playground, type of undersurface, and level of adult supervision. 79 of the victims had fractures, mainly upper limb, of which 30 occurred on surfaces designated by the authors as ‘soft.’ The authors reached the following conclusions: that the surface below equipment has no influence on either the type or severity of injury; that adult supervision does not influence injury patterns on playgrounds. An absent and potentially important factor is some measure of exposure to the surface types considered.

Laforest et al.⁶⁷ were amongst the few to investigate the issue of the suitability of grass surfaces in playgrounds, an issue largely side-stepped by the other studies reported here because of the tendency to deliberately or arbitrarily assign grass to the same category as concrete. 930 children reporting to Montreal’s two children’s hospitals for a fall-related injury involving playground equipment formed the cases. Demographic data and accident descriptions were obtained by telephone interview combined with some visits to playgrounds to confirm details. Cases were assigned to one of three surface types (sand, grass and other) but the overall exposure of Montreal’s children to these surfaces was not measured. Furthermore, the nature of surfaces under equipment was highly correlated with the type of location e.g. grass was mostly found in home play areas and less so in municipal or school playgrounds.

The authors classified injuries according to severity by separating out ‘fractures and head injuries’ from ‘other injuries’, ‘other injuries’ being taken as less severe. They then looked at the proportion of severe injuries, as defined, arising in falls onto each surface type. The proportions

⁶⁴ D. L. Mowat, F. Wang, W. Pickett and R. J. Brison, ‘A case-control study of risk factors for playground injuries among children in Kingston and area,’ *Injury Prevention*, 4, 39-43, 1998.

⁶⁵ From a UK perspective, differentiation between injury types is important because impact attenuating surfaces have not been introduced to reduce the risk of minor injuries such as cuts and bruises, but more serious injuries. Furthermore, minor injuries have little impact upon the legal concept of ‘reasonable practicability.’

⁶⁶ M. L. Waltzman, M. Shannon, A. P. Bowen and M. C. Bailey, ‘Monkeybar injuries: complications of play,’ *Pediatrics*, 103 (5), e58, 1999.

⁶⁷ S. Laforest, Y. Robitaille, D. Dorval, D. Lesage and B. Pless, ‘Severity of fall injuries on sand and grass in playgrounds,’ *J. Epidemiol. Community Health*, 54, 475-477, 2000.

were 61% for sand, 75% for grass and 67% for 'other' surfaces. It was concluded that the risk of fractures and head injuries on grass was 1.7 times that on sand, largely on the basis of which the authors recommend that grass is not a good protective surface under play equipment and should be removed. This is a rather strong recommendation which also strays well beyond science and into policy, although other factors necessary for the formulation of policy are given passing mention. A few comments on the study itself are that the children involved were quite young (average age of 5.8 years); that since most of the grass-based equipment was located in the home environment there may be an effect stemming from the likely different equipment found in back gardens compared with municipal and school playgrounds; and that the odds ratio itself is also quite modest. Potential benefits of grass as a play surface have also been disregarded.

Finally, Macarthur et al.⁶⁸ report a case control study of children reporting to a Toronto A & E department because of falls from playground equipment. In this study cases, of which there were 67, were defined as children with a severe injury (AIS⁶⁹ ≥ 2), and controls (59) as those with a minor injury (AIS < 2). Detailed demographic, exposure, and injury data were collected, and the specific playground and equipment involved were examined for cases and controls. Statistical analysis found the only significant predictor of injury severity to be fall height. Falls of greater than 1.5 m were associated with a 2-fold increase in risk of severe injury compared with falls from below 1.5 m. To the apparent surprise of the authors, under-surfacing type was not identified as a risk factor. Some suggestions as to why this might have been the case are advanced. One is that fairly few children fell onto non-impact absorbing surfaces, so the power of the study is low. It is also noted that under-surfacing was rather thinly spread, for example, loose-fill depths averaged 3 cm only. It is also of interest to note that, as with the Chalmers et al. study, the majority of cases (82%) had upper extremity injuries whereas for controls there were rather few of these (9%), with most injuries to controls affecting the lower extremities or the face and neck. This again points towards body orientation on impact as perhaps the most important determinant of fracture risk.

What might be concluded overall from these studies?⁷⁰ It would appear that height of equipment is felt by the investigators who examined this variable to be the most important of the risk factors

⁶⁸ C. Macarthur, X. Hu, D. E. Wesson and P. C. Parkin, 'Risk factors for severe injuries associated with falls from playground equipment,' *Accident Analysis and Prevention*, 32, 377-382, 2000.

⁶⁹ Abbreviated Injury Scale – a method of ranking injuries according to threat to life potential. An AIS score of 1 or 2 typically involves abrasions, laceration and sprains. An AIS score of 2 includes closed fractures of extremities. An AIS of 3 refers to conditions considered severe but non-life threatening, 4 to conditions both serious and life threatening, 5 to critical conditions with survival uncertain, and 6 to currently untreatable conditions.

⁷⁰ In considering studies of risk factors, readers should be very aware that for relative risks of the order of two or less the association is judged as relatively weak, requiring interpretation to be wary of sources of bias (i.e. selection bias, misclassification, or confounding) (G. Pershagen, 'Interpretation of epidemiological studies with modestly elevated relative risks,' Chapter 8, 191-200, In: 'What Risk?: Science, Politics and Public Health,' ed. R. Bate, Butterworth Heinemann, 1999. ISBN 0 7506 4228 9). A 1995 review in the leading scientific journal 'Science' ('Epidemiology faces its limits,' vol. 269, 164-169) likewise advises much caution in interpreting modest risk factors as sure signs of causal relationships. As a guide, Sir Richard Doll of Oxford University is quoted as follows:no single epidemiologic study is persuasive by itself unless the lower limit of its 95% confidence level falls above a threefold increased risk. Other researchers, according to the same review, opt for a four-fold increase as the lower limit. Dimitrios Trichopoulos, head of epidemiology at the Harvard School of Public Health, warns that, with epidemiology stretched to its limits or beyond, studies will inevitably generate false positive and false negative results "with disturbing frequency." Studies reporting modest risk factors therefore require replication and further

which they chose to study. The strongest evidence for this emerges from the works of Chalmers et al. and Macarthur et al., but is supported by several other authors. However, body orientation on impact, although not discussed in detail by any author, appears as a perhaps more important variable in the absolute sense. It is possible also that there may be a (probably weak) correlation between fall height and body orientation on impact and also whether or not falls occur onto extended (and vulnerable) arms, since with greater fall heights there is, firstly, more time to react and the natural reaction would be to extend one's arms in a fall (particularly for older children), and secondly, there is more time for the body to invert due to the head to body weight ratio (especially of younger children).

So far as under-surfacing as a risk factor is concerned, clearly some studies find benefits, some find no effect, and one even finds dis-benefits. Overall, given the difficulty of carrying out these studies and the need to control for confounders such as equipment/fall height (few of the studies were able to do this), which would tend to mask any association, one might be tempted to cautiously attribute some safety benefit to certain kinds of surfaces. In terms of the associated risk factor, this benefit would appear to be rather small, although in practice it could still account for a significant number of cases if the exposure were high. The limited size of the risk factor may be because compensatory mechanisms are at work, for example, children may take more risks in domains which appear safer, parents may supervise less if safety is perceived, and so on, or it may be that the special surfaces are less effective in dealing with the kinds of injuries occurring than had been hoped (for example, the effect of body orientation on impact may swamp other factors). It should not be forgotten that impact absorbing surfaces were never designed to deal with other than certain kinds of life threatening brain injuries and that any benefits which emerge with regard to, say, limb protection are therefore serendipitous.⁷

However, even had large and significant risk factors emerged, there would still remain the question of the reasonableness of proposed mitigation measures. Measures such as reduced height of equipment, use of impact absorbing surfaces, removal of grass-surfaces from playgrounds, removal of certain types of equipment, as called for by some investigators, all have many implications besides those for safety. These very important matters are considered further in Chapter 7 and Appendix B.

4.3 BIOMECHANICAL STUDIES OF FALLS

As noted, impact absorbing surfaces were designed to reduce the risk of certain kinds of brain injuries. Because of the preponderance of limb injuries in playgrounds, one might hope that benefits might also accrue here. Some of the epidemiological studies described in section 4.2 address this matter. Another avenue of investigation is via biomechanical studies that investigate how human bodies respond to impacts with surfaces of various kinds.

Chapter 4 of the 1989 report⁷ reviewed the then research on falls and related injuries. The most relevant findings were as follows:

- falls in childhood from all causes are exceedingly common

scrutiny before they can be taken as conclusive. In this context, the Chalmers et al. and Macarthur et al. studies use similar methodologies and consistently find fall height to be a risk factor, although not undersurface. On the other hand, the Chalmers et al. study does find an intriguing and plausible dose-response relationship between increasing fall height and risk.

- there is evidence that children in falls, unlike adults, tend to rotate towards a head first position, probably because of their distribution of body mass. However, most evidence is derived from falls over considerably greater distances than would be conceivable in playgrounds
- the magnitude of injury resulting from a fall to a surface is dependent on the body's orientation at impact (for one thing, the stress, or force per unit area, on an impacting body is inversely proportional to the area of contact, and so is less for e.g. side-first impacts than impacts on hands); the fall height; the nature including flatness of the surface; the mass of the victim; the victim's physical and mental condition; the victim's ability to distribute impact forces effectively (and, from footnote 40 of this report, the existence of any inherited or acquired disease affecting bone growth)
- the commonest and usually mildest brain trauma is concussion and is brought about by rapid acceleration of the head
- studies of fall consequences for children show little or no correlation between fall height and head injury severity for falls of less than 6 metres
- the various head injury criteria in use (whether based on peak g, Severity Index, or Head Injury Criterion) all presume a tolerable level of risk i.e. do not guarantee safety from serious brain injury in head first falls

Some further biomechanical studies of falls have since been published providing fresh insights. These deal primarily with upper limb fractures which are of course highly relevant so far as this study is concerned.

Farnsworth et al.⁷¹ report on the occurrence and pathomechanics of supracondylar fractures in San Diegan children, finding these to be common childhood injuries and accounting for the majority of childhood elbow fractures. In the vast majority of cases the cause was a fall onto an outstretched arm, with monkey bars in playgrounds being the predominant location from which these falls originated. The authors describe the prototypical scenario for supracondylar fracture which emerged from their study as one of a 6 year old girl who slips from monkey bars, attempts to hold on with her dominant hand, and lands on the ground with her extended non-dominant hand.

Nevitt and Cummings⁷² report a somewhat different study, of elderly women and the occurrence of hip and wrist fractures from falls, but which still has a bearing on this project. These authors had previously hypothesised that, when a person falls, the nature of the fall influences whether a fracture will occur and also the type.⁷³ The authors investigated many variables, one of which was type of surface on which the fall occurred.

Nearly all women who suffered a wrist fracture (88%) recalled falling onto a hand or wrist, whereas for those who had fallen but not experienced a fracture only 46% fell in this way (odds ratio of 20.4). On the other hand, the reported height of fall, hardness of landing surface, triceps strength, obesity, and body fat distribution were not significantly associated with the risk of wrist fractures in women who fell on a hand.

⁷¹ C. L. Farnsworth, P. D. Silva and S. J. Mubarak, 'Etiology of supracondylar humerus fractures,' J. Pediatric Orthopaedics, 18, 38-42, 1998.

⁷² M. C. Nevitt and S. R. Cummings, 'Type of fall and risk of hip and wrist fractures: the study of osteoporotic fractures,' J. American Geriatrics Society, 41, 1226-1234, 1993.

⁷³ S. R. Cummings and M. C. Nevitt, 'A hypothesis: the causes of hip fracture,' J. Gerontol. Medical Science, 44, M107-111, 1989.

Overall, these results confirm the authors' hypothesis concerning the importance of the nature of a fall on the consequences. Also apparent was that for older fallers there was a reduced tendency to use a hand to break a fall and, because of declining strength with age, such attempts might anyway have been less effective. This raises the possibility of similar factors affecting the falls of young and very young children in playgrounds, whose speed of reaction, arm strength, and body mass distribution vary significantly with age during early years.

Robinovitch and Chiu^{74, 75} report on biomechanical factors affecting the risk of injury during falls onto outstretched hands, a little researched but potentially crucial issue relating to these familiar childhood injuries. In common with Farnsworth et al.,⁷¹ they report that 90% of fractures of the distal radius, humeral neck, and supracondylar region of the elbow, result from falls onto outstretched hands. In particular, they examined the ability of compliant surfaces to attenuate upper extremity impact forces during a fall. Their study relied upon experimental tests using adult volunteers, and mathematical modelling. Despite some, practically unavoidable, limitations, for example, use of adults rather than children as subjects, and the fact that only forward falls were considered, the work is nonetheless unique and instructive.

To summarise, it was found that the force on the hand comprises an initial high-frequency component (F_1) occurring shortly after the instant of contact (~20 ms), followed by a lower frequency component (F_2) occurring a fraction of a second later (~110 ms). So far as the surface fallen onto is concerned, the study indicates that compliant surfaces do attenuate F_1 but that in the case of falls from heights which are typical of those in playgrounds, F_2 may rise to injurious levels irrespective of the surface type and thereby initiate fracture. The authors conclude that to reduce the risk of these kinds of fractures in playground environments would require both padded surfaces and height restrictions on equipment. The results indicate that for 'worst case' fall conditions, fall heights would need to be less than 1.5 m to prevent F_2 from approaching the mean fracture force for the arm.⁷⁴

4.4 IMPACT ATTENUATION OF SURFACES

Two recent studies have been found in the academic literature which report on the impact attenuation of various surfaces. The first, by Lewis et al.,⁷⁶ involved testing of boxed surface samples in the laboratory. The surfaces tested were sand, gravel, wood chips, grass sod, and 2 inch thick rubber matting. An instrumented test sphere was dropped onto each surface type from a fixed height of 60 inches (1.54 m) and the peak deceleration and impact duration were measured. Interestingly, the surface types were tested under four conditions: warm and dry; frozen and dry; warm and wet; frozen and wet.⁷⁷ The results were reported in terms of peak deceleration (peak g) and head injury criterion (HIC). Readers are reminded that these tests relate

⁷⁴ S. N. Robinovitch and J. Chiu, 'Surface stiffness affects impact force during a fall on the outstretched hand,' *J. Orthopaedic Research*, 16, 309-313, 1998.

⁷⁵ J. Chiu and S. Robinovitch, 'Prediction of upper extremity impact forces during falls on the outstretched hand,' *J. Biomechanics*, 31, 1169-1176, 1998.

⁷⁶ L. M. Lewis, R. Naunheim, J. Standeven and K. S. Naunheim, 'Quantitation of impact attenuation of different playground surfaces under various environmental conditions using a tri-axial accelerometer,' *J. Trauma*, 35 (6), 932-935, 1993.

⁷⁷ This at least was the intention, but for some it proved not possible. For example, the grass sod could not be frozen and was therefore not tested in this condition.

only to head injury protection measures and their relationship, if any, with risk of injury to other body parts is largely speculative.

The results showed that in the warm dry state, wood chips had the lowest (and therefore presumably best) peak g of around 60g. This can be compared with a peak g of 200g which is conventionally taken as the borderline of acceptability (but see King and Ball⁷ Chapter 4 for a discussion of what this really means). In this state, sand, grass and rubber matting performed similarly (peak g of ~150g). In the frozen dry state there were modest changes only in peak g values for all surfaces.

In the warm wet state, wood chips were again superior (60g), though only marginally so over the other four surface types. In this state the highest peak g was ~150g for rubber mats, though still well inside the 200g criterion.

In the frozen wet state the most noticeable effect by far was the deterioration in the performance of sand, which returned a peak g of 450g. The other surfaces also returned higher peak g values compared with the warm wet state, but effects were less marked and none exceeded 200g.

Peak g values have recognised limitations as measures of head injury risk because no account is taken of impact duration which is also known to be an important predictor of clinical effects.⁷ For this reason, composite criteria such as HIC have been developed and, in fact, HIC is the more widely used measure in Europe, with a HIC score of 1,000 most often being chosen as a borderline of acceptability. In fact, for the drop height (1.54 m) used in this study, none of the surfaces tested exhibited HIC scores anywhere near the 1,000 value under any conditions, the highest being 677 for warm wet matting, with the rest coming in at ≤ 300 . Also of note is that the peak g and HIC scores were not well correlated. For example, sand in the wet frozen state performed 'badly' on peak g and 'well' on HIC.⁷⁸

The second study, by Robitaille et al.,⁷⁹ describes measurements of peak g values in park playgrounds in Montreal. The method of experimentation was clearly influenced by North American Standards and the results are therefore less easy to interpret from a European perspective. Injudiciously, the authors use words like 'dangerous' to describe any situation with a peak g of $> 200g$, whereas, as the previously referred study shows, the relationship between measurement and reality is complex. Nonetheless, the paper raises some interesting issues.

Overall, the average peak g, measured from the tops of 356 pieces of equipment, was found to be 165g. Under-surfaces included mainly sand and grass or earth. Measurements were made in summertime. Surface moisture at the time of testing is not reported, but visual observations of surface compaction are. Using the peak g criterion of 200g as a test of acceptability, the authors found 14% of surfaces otherwise apparently in compliance with the Canadian Standard to have peak g values $> 200g$, and 26% of those not complying to have peak g values above 200g. The

⁷⁸ Lack of correspondence between these measures has been known of for many years. For example, the Dutch TNO laboratory has reported drops of a test head-form from 1 m onto ground and 3.5 m onto tree bark. The peak g values were similar (104g and 109g), but the HIC values were very different (298 and 647). This is because the signal from the tree bark is much longer, there being more energy to dissipate because of the greater fall height (M. A. M. Holierhock and J. Kooi, 'Voorstudie bodemmateriële', TNO Report B-87-261, 1988).

⁷⁹ Y. Robitaille, S. Laforest, D. Lesage and D. Dorval, 'Search for a simple means to identify dangerous surfaces under play equipment,' J. Safety Research, 31 (1), 29-34, 2000.

authors report that no g values exceeded 200g for equipment less than 1.5 m in height whatever the visual state of compaction of the surface. Above 1.5 m, g values could exceed 200g and this was found to be more likely with surfaces which were apparently compacted.

On the basis of this study the authors recommend that equipment should not be higher than 2 metres until such time as technological progress can produce cheap, safe surfaces that are easy to install and maintain. However, surface selection is a complex business and there remains a cascade of unanswered questions and uncertainties. These range from issues of resources (also identified by the authors), to matters of practicability, alternative merits (besides safety) of different surface types, to questions about the scientific method of test itself and its audit trail of credibility as an injury mitigation measure.

Regarding the latter, a question should be raised about the use of criteria such as a peak g of 200g as a presumed valid and precise measure of the presence or absence of danger. In the Robitaille et al. study, for example, the mean peak g values, even for the 'worst case scenario' of compacted surfaces with fall heights of >2.0 m, are not more than marginally above, at 215g, the 200g criterion used by the authors. What this means in terms of the real issue of concern, actual risk to children, is almost impossible to say on current knowledge because of numerous uncertainties. These include, to name a few, the fact that peak g is a criterion designed to address the risk of certain head injuries and not the far more prevalent limb injuries; that peak g does not take account of impact duration which might be important, and that HIC scores which do are not necessarily correlated with peak g; that, in the light of the Lewis et al.⁷⁶ results, surfaces might perform differently under wet or frozen conditions; that there are several at least methodological issues which give rise to variability in peak g measurements;⁸⁰ and that rather few people appreciate that a peak g of 200g is itself based on a value judgement about how much risk is tolerable and not upon the elimination of risk. There are in fact so many uncertainties and value judgements at all stages of the process that the selection of any criterion of this kind is substantially arbitrary. This implies that care should be taken lest unwarranted precision be assigned to some numerical criterion simply because it is stated as a number and without explanation of its limitations. Failure to be circumspect in such situations can lead to policy being driven by numbers which have only a marginal connection with reality, in this case the occurrence of injuries, something which negates the utility of research and which should obviously be avoided whenever possible.

4.5 PLAY OBSERVED MINUTELY

A further group of studies has taken yet another approach to the investigation of playground safety. This is a reference to investigations which extract very detailed information on accident or near-accident scenarios by use of intensive follow-up interviews or even real-time videos of playground activities. Such studies are fairly rare, being time consuming and expensive, but nonetheless are exceedingly valuable in understanding what actually happens in accident situations. As Waller has said, "The complexity of these (playground) interactions means that a simple categorisation of cause will not always provide the full picture: knowledge of how factors interact with each other to produce or avoid injury events is needed."⁸¹

⁸⁰ See, for example, G. F. Sushinsky, 'Laboratory tests of playground surfacing materials – should ASTM F 1292 be revised?' Proceedings of 'Playground Safety,' Penn State, 1999, edited by M. L. Christiansen. ISBN 0 960342 1 6.

⁸¹ J. A. Waller, 'Accident prevention: the role of research,' In: Accidents in Childhood and Adolescence, eds. M. Manciaux and C. J. Romer, WHO, Geneva, 1991.

4.5.1 The PRAV Study

In 1992 a particularly novel and insightful study of playground accidents was reported by the Playgrounds and Recreation Association of Victoria (PRAV) in Australia.⁸² The significance of this study was its pioneering approach to playground accident investigation, involving in-depth interviews with children, parents and caregivers following accidents, an approach recommended some five years later by Coppens and Koziara.⁸³ The project involved in-depth interviews with 161 injured children and their parents or caregivers, as well as site owners. A random stratified sample of children under 15 years was used, and playgrounds of various types were included – playgroup, school, public, and commercial. Consultant reports were also collected on the play equipment used at the time of the accident.

The main findings include the following:

- equipment was involved in less than one third of the cases
- over three quarters of cases involved behavioral elements, either of the victim or other parties
- the upper limb was the most common injury location; head injuries accounted for 20% of cases and few warranted hospital admission
- although climbing frames and monkey bars were associated with most of the equipment-related injuries, fairly few involved head impact with the ground
- fall distance was not found to be a risk factor in relation to medically-assessed injury severity⁸⁴
- head injuries rated as ‘severe’ more commonly resulted from collisions, either with equipment, other children or fencing/containment rather than from direct falls to the ground despite the observation that few playgrounds in the study had much in the way of impact absorbing surfacing. Few of the head injuries classified as severe affected the skull, the majority being facial or dental injuries.

Overall, Pain concludes that the most important risk factors in relation to equipment-related injuries are: the unsafe behaviour of children due to distraction, over-exertion, playful aggression, wanton aggression, and trying something new; and design problems which were detected by this close investigation of the way in which equipment was actually used as opposed to its designed for use.

4.5.2 Real time observation

Also belonging in this category of ‘closely-observed playgrounds’ is a study by Coppens and Gentry⁸⁵ in New England which used video analysis to investigate injury and near-injury situations on two school playgrounds. As noted by the authors, the use of injury reports as a

⁸² D. Pain, ‘Children’s playground equipment related injuries,’ PRAV, 1992.

⁸³ N. M. Coppens and D. M. Koziara, ‘Children’s perceptions concerning school injuries,’ J. School of Nursing, 13 (3), 14-19, 1997.

⁸⁴ The data are now being re-analysed. There is a possibility that fall height may after all emerge as a risk factor although, as Pain has said (p 193), most children interviewed considered that awkwardness of falls had more to do with their injuries, particularly when falling forward from a low height.

⁸⁵ N. M. Coppens and L. K. Gentry, ‘Video analysis of playground injury-risk situations,’ Research in Nursing & Health, 14, 129-136, 1991.

source of information is valuable but limited as it has to rely upon reconstruction of the events leading up to the injury and this has often to be done on the basis of partial information. The camera, on the other hand, is less likely to lie.

On the basis of this work the authors concluded that the factors contributing to any single, typical accident or near-accident were multiple. When actions of the victim and other children were examined, it was found that either, they did not contribute to the event, or they contributed in a non-aggressive way (e.g. running, jumping and using equipment improperly), or they contributed in an aggressive way (e.g. pushing, fighting, kicking etc.). The most frequently viewed of these behaviours was 'using equipment improperly.' It was also noted that the frequency of occurrence of hazardous situations was less when class teachers were present than when monitors were used. Overall, the frequency of occurrence of hazards was a function of gender (boys were more aggressive on average than girls), aggressive actions, equipment and supervision.

5. ASSESSING BENEFITS

Summary of Main Points from this Chapter

- The view is strongly held in the UK play community that playgrounds should introduce children to some degree of real risk. The importance of this viewpoint is that it influences the final outcome of the risk assessment-risk management decision process, specifically, the level of risk that is finally found to be acceptable. Clearly, this influence does not exist in conventional workplace settings. Simply put, in playgrounds, risks are held to serve some purpose; in conventional factories, they are not. A further implication is that the legal concept of '(reasonably) foreseeable risk' should not be interpreted in playgrounds in the same way as in factories.
- Playgrounds are widely held to offer a broad range of essential opportunities for child development. These have been largely neglected by western science, probably because their study is less conducive to investigation by reductionist methodologies. This of course does not mean the benefits are unimportant.
- Because of the difficulties inherent in measuring benefits, the plus side of play is more underpinned by beliefs than by science. However, this is not an especially unusual situation in risk decisions and should certainly not exclude beliefs about play value from consideration in the final analysis.
- There is modest evidence in support of some perceived benefits. For example, that the provision of playgrounds reduces risk to children by getting them away from more risky places. This should act as a caution to any who contemplate reducing provision for whatever reason.

5.1 WHY CONSIDER BENEFITS?

The purpose of this Chapter is not to attempt such a full review, as has been done for risk, of recent ideas and research on the benefits of play, since this would be equally if not more voluminous than what has already been written, and is not the primary focus of the report. Nonetheless, it is essential, in considering the risk of some activity, to also take account of its benefits. This is particularly necessary in dealing with the topic of playgrounds because, all too often, it appears that the hazards present in playgrounds are considered with scant reference to the reasons why playgrounds (or the hazards in playgrounds) are there. For example, there is a tendency to make decisions about risks in playgrounds as if they were akin to a factory. Clearly, no one in their right mind would incorporate a fireman's pole into a normal workplace^f as a routine means of descent, nor a wobbly chain-linked bridge as a means of crossing from one elevated level to another. Nor would such inventions as swings, roundabouts, rocking horses and climbing frames be permitted in workplaces because they would constitute *unnecessary and foreseeable risks*. This would be regarded as creating a hazard without any purpose, and would presumably contravene the Health and Safety at Work Act.

^f 'Normal' here implies factories, offices, hospitals and the like. It is accepted that some workplaces – fire stations, armed forces training camps etc – might have such features.

On the other hand, playgrounds, as mentioned in Chapter 1, are also subject to this Act, so on what basis could they be treated differently? The answer is provided by the HSE, who, in expanding upon the interpretation of ‘reasonable practicability,’ produced a list of 40 additional factors that are potentially significant in decisions about risk.⁸⁶ Near the top of this list are the benefits of the activity. The view is that risky activities are undertaken for their benefits. If there are no benefits associated with an activity, then do not undertake it, but if there are benefits then the risk may be accepted providing an appropriate balance is struck.

5.2 UNAVOIDABLE DIFFICULTIES ASSOCIATED WITH PLAY BENEFITS

So what are the benefits of play? ‘Best Play’¹ is the most recent UK authoritative source and provides a summary which is straight to the point:

- provides children with opportunities to enjoy freedom, and exercise choice and control over their actions
- offers children opportunities for testing boundaries and exploring risk
- offers a very wide range of physical, social and intellectual experiences for children
- fosters independence and self-esteem
- develops respect for others and offers opportunities for social interaction
- supports well-being, healthy growth and development
- increases knowledge and understanding
- promotes creativity and capacity to learn

‘Best Play’ also identifies the consequences of a lack of play opportunities:

- poorer ability in motor tasks
- lower levels of physical activity
- poorer ability to deal with stressful or traumatic events
- poorer ability to assess and manage risk
- poorer social skills

For anyone who ‘believes’ in the importance of play for children, as apparently do most people who have thought deeply about it, this list provides a compelling justification of need. However, it has a ‘weakness,’ which is that these benefits and disbenefits are not easily substantiated by accepted western scientific methods. Consequently, they are frequently disregarded by scientists and safety engineers who have a tendency to ignore factors not amenable to quantitative methods of scientific analysis or which are unrelated to their own particular specialisms, as taught. Even in the case of respected international conferences on playground safety,⁸⁷ the number of papers that pay more than lip service to play benefits is modest. (It is interesting to note that, of the few papers at the 1999 Monty Christiansen conference which dealt with the benefits of play, two originated from the East^{88, 89}). The pitfalls of this should be obvious. If the purpose of an activity

⁸⁶ Health and Safety Executive, ‘Quantified risk assessment: its input to decision making,’ ISBN 0 11 885499 2, 1989. See Appendix 1.

⁸⁷ For example, the Penn State conferences on Playground Safety in 1995 and 1999, reports of which are edited by M. L. Christiansen, ISBN 0 9650342 0 8 and 0 960342 1 6.

⁸⁸ J-S. Hou, ‘Physical environment and children’s social play in playgrounds,’ Proceedings of ‘Playground Safety,’ Penn State, 1999, edited by M. L. Christiansen. ISBN 0 960342 1 6.

is not directly considered, then a balance between risk and benefit cannot be struck and one is in danger of considering only one side of the equation. Adams has asserted that failure to consider the benefits of risky activities in making management decisions is analogous to operating an air conditioning system with a defective thermostat in which the feedback loop is absent.⁹⁰ It simply overheats.

Furthermore, it is apparent from this list that, so far as play is concerned, risk has been attributed a very unusual role by the signatories, namely, that the presence of risk itself is seen as a *positive attribute* of playgrounds.⁹¹ To elaborate, “Play is a key element in children learning to appreciate, assess and take calculated risks, which is fundamental to the development of confidence and abilities in childhood. Children seek out opportunities for risk-taking and it is the responsibility of play provision to respond with exciting and stimulating environments that balance risks appropriately.”⁹¹ This is in stark contrast to, say, the workplace where risks are seen as having no intrinsic benefit, existing merely as an unavoidable or tolerable evil. The reason that risk in playgrounds is seen as beneficial is that it is believed to give children a chance to learn, in a real way, about the pros and cons of risk taking, without being exposed to the far more consequential risks of some other venues which they will later encounter.

So, although it may indeed be true that playgrounds do constitute an important learning situation for children in which they can come to terms with more modest risk through their own experiences, before having to face the more serious risks posed by adulthood, this in particular is not something amenable to scientific proof. The position, in fact, owes far more to beliefs than it does to objective evidence. However, it should be stressed that this intrusion of beliefs into a decision process is by no means unusual. The philosopher Seedhouse, for example, has described how in fact most if not all decisions about health (Seedhouse was writing in the context of health but his ideas are readily transferable to safety), even those believed to be value-free, are in fact value-laden.⁹²

Clearly, some cultures are more ready to accept this proposition than others. Anecdotally, for example, the scientist Peat, in a study of native American cultures, describes a situation in which a Blackfoot boy in a fishing boat was in danger of colliding with submerged rocks, yet his father, who was nearby in another boat, called out no warning (although he was vigilant), whereas he (Peat) would have.⁹³ While this perhaps does not make much sense from a Western cultural perspective, at least that part of Western culture which adheres more strictly to evidence-based beliefs, the notion that “you cannot “give” a person knowledge in the way that a doctor gives a person a shot for measles,” is one which cannot be dismissed as entirely irrational.

So, if it were either true, or chosen to be accepted as true, that playgrounds provide an important risk experience for children, then one might be concerned that playgrounds could be too safe.

⁸⁹ S-H. Lee, ‘The cognition of playground safety and children’s play – a comparison of traditional, contemporary, and naturalized playground types,’ Proceedings of ‘Playground Safety,’ Penn State, 1999, edited by M. L. Christiansen. ISBN 0 960342 1 6.

⁹⁰ J. Adams, ‘Risk,’ UCL Press, ISBN 1 85728 068 7, 1995.

⁹¹ This, of course, cautions against any simplistic application of the concept of ‘foreseeable risk’ which is often used in British courts as a measure of whether or not a playground was dangerous.

⁹² D. Seedhouse, ‘Health promotion – philosophy, prejudice and practice,’ Wiley, 1997. ISBN 0 471 93910 2.

⁹³ F. D. Peat, ‘Blackfoot physics: a journey into the native American universe,’ 58-59, Clays, 1994. ISBN 1 85702 331 5.

Bizarre though this prospect may seem, it is not a novel hypothesis. Adams, for example, has posed the following question of the Royal Navy, “does the Navy have enough accidents?”⁹⁴ And RoSPA’s widely-experienced Heseltine has also added his own angle to this debate by expressing concern over what he regards as “emasculated” play equipment, via his observation that “We have made playgrounds so monumentally boring that any self-respecting child will go somewhere else to play, somewhere more interesting and usually more dangerous,”⁹⁵ echoes of which can be found in children’s responses to the Pain interviews.⁸²

In line with Heseltine’s suggestion that children might be driven into more dangerous environments by overly safe (emasculated) playgrounds, this is clearly an important issue but similarly is not at all one which is easily researched by the reductionist methods of conventional science. But, given that, as described in Section 4.1.2, there are 500 to 600 child fatalities from accidents of all types in the UK each year, compared with less than one in playgrounds, there is the potential for a multiplying effect if children were to be displaced from playgrounds to some other place for whatever reason. Sharples et al.⁹⁶ make essentially this point in their 1990 study of fatal head injuries to children in Northern England. Play is an essential part of child development; over half the children in their study were playing at the time they were killed; over half died in road traffic accidents. This is another allusion to the potential for a ‘multiplying’ effect.

5.3 MODEST EVIDENCE

One scientific study which does try to get to grips with some of these semi-tangibles examines the effect on childhood risk of the absence, as opposed to the presence, of accessible playgrounds.⁹⁷ In this study, matched groups of children in Dusseldorf were compared. The ‘cases’ constituted children who had suffered an injury, and the ‘controls’ children who just lived in Dusseldorf but who had the same age and sex characteristics. *Inter alia*, there were found to be significantly more playgrounds around the houses of controls compared with the houses of cases. The odds ratio was 1.8 for houses without playgrounds in the vicinity compared with houses having four or more playgrounds. This odds ratio is not large, but nor is it so different from some of the odds ratios which have resulted in calls for more stringent height restrictions on equipment or for impact absorbing surfaces in playgrounds. With less of a scientifically framed argument, the Harlem Hospital Injury Prevention Program also claims to have decreased major injury trauma from motor vehicle incidents by increasing availability of safe play areas for children.⁹⁸

Elsewhere, Boulton reports on another supposed positive aspect of playgrounds. This concerns the fact that a large proportion of middle school children will be involved in aggressive fighting at one time or another while in school playgrounds, something which is partially at least related to the use of space⁹⁹ and presumably design. This raises the question of the extent to which

⁹⁴ J. Adams, personal communication, 2001.

⁹⁵ P. Heseltine, ‘Confessions of a playground safety adviser,’ HAPA Journal, 13, 16-17, 1994.

⁹⁶ P. M. Sharples, A. Storey, A. Aynsley-Green and J. A. Eyre, ‘Causes of fatal childhood accidents involving head injury in Northern region, 1979-86,’ British Medical Journal, 301, 1193-1197, 1990.

⁹⁷ R. von Kries, C. Kohne, O. Bohm and H. von Voss, ‘Road injuries in school age children: relation to environmental factors amenable to interventions,’ Injury Prevention, 4, 103-105, 1998.

⁹⁸ D. Laraque, B. Barlow, M. Durkin and M. Heagarty, ‘Injury prevention in an urban setting: challenges and successes,’ Bulletin of the New York Academy of Medicine, 72 (1), 16-30, 1995.

⁹⁹ M. J. Boulton, ‘Proximate causes of aggressive fighting in middle school children,’ British J. Psychological Society, 63, 231-244, 1993.

playground design¹⁰⁰ affects child safety and other attributes of the space, for example, the opportunities it provides for physical, social and cognitive development. Thus, it is reported by Barbour that children's playground behaviour varies depending on the type of playground they are using.¹⁰¹ Typically, playgrounds have been characterised as 'traditional' if they contain swings, slides and the like; 'contemporary' if they are based on modular equipment with multi-purpose linked structures; and 'adventure' if the equipment is moveable or modifiable, even by children themselves. It has previously been reported that children prefer adventure to contemporary to traditional playgrounds,¹⁰² but even within any single category there is considerable scope for providing different experiences. To consider just one aspect, Barbour concludes that: "Not only is it important to include equipment and materials that promote motor skill development of children with LPC (low physical competence) and provide opportunities for them to interact socially with peers, it is also important to physically challenge children with HPC (high physical competence). Playgrounds that accommodate the needs of same-age children on both ends of the motor skill spectrum will better promote the physical, social and cognitive development of all children."¹⁰¹

Another issue that has interested researchers is the effect that play might have on creativity. Susa and Benedict¹⁰³ tested three hypotheses: that more pretend play would occur on contemporary designed rather than on traditional playgrounds; that (because pretend play has been found to be positively correlated with creativity) more creativity would occur after playing on contemporary playgrounds; that playground design would be the best predictor of creativity. In all three cases support was found for the hypothesis from observations made although the authors acknowledge that, because of the difficulty of this kind of research, only a small study could be conducted and that more work was desirable.

Berretta and Privette¹⁰⁴ also report a study to investigate whether flexible play experiences have more positive effects on creative thinking than highly structured play experiences. This work was spurred on by the earlier observation that: "During the preschool years the major break on creativity is the tendency of our culture increasingly to shorten the period of play and imagination, so that by the time the child has developed intellectually to the stage at which he can engage in sound creative thinking he has come too often to regard his imagination as an inferior faculty."¹⁰⁵ In accord with the previous study, the finding was that flexible play experiences did have a positive influence on creative thinking in comparison with highly structured play experiences.

Collectively these studies, and others like them, raise a host of issues about children and playgrounds. What is the scope of playgrounds to encourage creativeness and other positive attributes if designed with these goals in mind? Would such play experiences have long-term

¹⁰⁰ The issue referred to here is not the spacing requirement for fixed equipment which is aimed at reducing the risk of collisions, but the design of the entire play space.

¹⁰¹ A. C. Barbour, 'The impact of playground design on the play behaviors of children with differing levels of physical competence,' *Early Childhood Research Quarterly*, 14 (1), 75-98, 1999.

¹⁰² D. Hayward, M. Rothenberg and R. Beasley, 'Children's play and urban playground environments: a comparison of traditional, contemporary, and adventure playground types,' *Environment and Behavior*, 6 (2), 131-168, 1974.

¹⁰³ A. M. Susa and J. O. Benedict, 'The effects of playground design on pretend play and divergent thinking,' *Environment and Behavior*, 26 (4), 560-579, 1994.

¹⁰⁴ S. Berretta and G. Privette, 'Influence of play on creative thinking,' *Perceptual and Motor Skills*, 71, 659-666, 1990.

¹⁰⁵ G. F. Kneller, 'The art and science of creativity,' Holt, Rinehart & Winston, New York, 1965.

implications for those exposed to them? Can playgrounds be designed to foster social skills? Do playgrounds act as relative havens of safety, despite their frequently alleged significant role in generating injuries? And, of course, what effect does the vigorous pursuit of safety in playgrounds have upon these other attributes of play?

5.4 PLAYGROUND RISKS - A STEP ON THE ROAD TO COPING WITH LIFE?

A large number of papers now demonstrate that numerous popular leisure activities¹⁰⁶ carry surprisingly high risks,¹⁰⁷ far outweighing those encountered in most work places.⁴² Thus, playing soccer or netball emerges, in terms of non-fatal injury risk, as a far greater hazard than even the supposedly dangerous occupations of working in a coal mine or on a building site. This has not prevented public participation in sport from being promoted by health education authorities because, apart from the social and psychological benefits to participants, they are widely regarded as reducing risks of serious threats to health in later years, such as coronary heart disease (CHD), stroke and possibly a plethora of other health problems.^{45, 108} In other words, the high risks of injury are considered worth tolerating in view of the reduced risks of more serious conditions later on.

So, perhaps it can also be argued that although playgrounds are associated with risk, the risk should be accepted in exchange for the health and other benefits associated with them, though, as discussed in Chapter 7, this would constitute a political judgement and not a scientific one, although it may be informed by science. Of course, children rarely suffer from conditions like CHD, but the point is that play encourages physical activity which, it is hoped, will be continued in other vigorous leisure forms for as long as possible. Fox, for example, reports that the attractiveness and availability of inactive pursuits has increased to such a level that even children are steadily getting fatter at earlier ages and that vigorous activity is low for many youngsters,¹⁰⁹ an issue also raised by 'Best Play.'¹

Furthermore, given the high risk of injury associated with popular sports, it is perhaps a plausible belief that children should be gradually exposed to real risk, rather than be shielded until such time as they are plunged into the mayhem of the normal world. Of course, this view would appear to run counter to the alternative vision of safe play, in which an attempt is made (or perceived to be made) to shield children totally from real risks by placing them in an artificial world. This notion, of safe play, is also based upon a belief about what the world should be like. However, experience suggests that, at least in the present state of development, such a goal is illusory. Its pursuit may also be counterproductive in that risks are simply transferred while benefits are lost.

¹⁰⁶ Leisure activities are used as comparators since play can also be considered as approximating most closely to a leisure activity.

¹⁰⁷ P. E. Bijur, A. Trumble, Y. Harel, M. D. Overpeck, D. Jones and P. C. Scheidt, 'Sports and recreation injuries in US children and adolescents,' *Archives Pediatr. Adolesc. Medicine*, 149, 1009-1016, 1995.

¹⁰⁸ A. Weir, 'Physical activity and health: a literature review,' *J. Sports Exercise and Injury*, 4, 97-101, 1998.

¹⁰⁹ K. Fox, 'The theft of childhood,' *Expression*, 8, summer 1997.

6. BEHAVIOUR *versus* ENVIRONMENT

Summary of Main Points from this Chapter

- Surveys of parent's attitudes identify signs of apparent conflict. On the one hand there is concern over what is perceived as 'heavy regulation' of children who have less freedom than they in their youth, while on the other hand safety of playgrounds and the environment as a whole is also a cause of parental anxiety which inclines to less freedom.
- The problems of play and activity provision are seen by some as more acute for the early teenage group.
- A study of children's perceptions of why they had an accident suggests that they believe the situation to have been avoidable through their own actions in 30% of cases.
- There is evidence that the answer to the long-standing question as to why boys have more accidents than girls is attributable to parental, particularly maternal, attitudes to risk taking by their offspring. Mothers tend to be tolerant and encouraging of risk-taking by boys whereas girls are discouraged.
- Parental disciplinary styles also appear to influence playground behaviour. An 'inductive' disciplinary style (based on logical argument) is associated with less disruptive playground behaviour and less rough play than a 'power-assertive' style (using threats and punishment).
- Various beliefs exist about how best to tackle risks on the playground and play areas in general. Some are convinced that playgrounds are best treated with technological solutions such as compliance with product standards and that approaches based on education and advice are ineffective. Others are confident that suitable design affects behaviour, which in turn lessens risks of all kinds of undesirable behaviours and promotes good ones including social skills.

As described in the opening paragraph of Chapter 1, playgrounds engage interests from many different disciplines, each of which brings its own perspective to bear on what are the purposes and how they should be achieved. In this Chapter some further research is described which has been arranged as follows. First, an account is given of some recent studies that investigate perceptual factors affecting play, and then of social influences upon behaviour and risk taking by children in play situations. Second, another group of papers is described which takes a very different line – that of improving playgrounds by providing a 'safe' environment, and yet another which believes that playground design can itself influence behaviour in a positive way.

6.1 SOCIAL APPROACHES TO UNDERSTANDING PLAY AND BEHAVIOUR

Various studies report on the perception of risk in relation to some aspect of children's play. Valentine and McKendrick,³ for example, provide a recent British perspective of the adequacy of play provision as perceived by parents of 8 to 11 year olds. This work was stimulated by, in particular, the widespread popular concern, also supported by academic research,^{5, 110} over the future of children's outdoor play and the conventional wisdom that contemporary children are being denied the outdoor play opportunities afforded to previous generations. The study investigated public perceptions in NW England regarding the adequacy of play opportunities in their neighbourhoods for their children, including safety concerns. Methods used include postal questionnaires and semi-structured interviews of a sample of parents of 8 to 11 year old children.

As with an earlier study by Barnado's,⁴ this survey found that the vast majority of parents were dissatisfied with the provision of play facilities, the problems being seen as most acute for older children and those living in predominantly working class areas.¹¹¹ Most parents felt that, compared with their own childhoods, contemporary children were less exposed to outdoor play and were more heavily regulated than they themselves had been. Evidence was also found of temporal and spatial trends over the last three decades. It would appear that fewer children play outside these days, and those who do are more closely centred on the home than further afield. However, the evidence of this paper is that the most significant factor affecting children's access to play facilities is not in fact the level of public provision but parental anxieties about children's safety.

Elsewhere (N. America), several groups of investigators have reported on alternative perceptions of a number of aspects of children's play. For example, Coppens and Koziara⁸³ interviewed US elementary school children following school accidents, most of which occurred on the playground, to discover the extent to which the children themselves believed they could have avoided the accident, or, alternatively, that it was attributable to someone or something outside of their control. About 30% of the children interviewed felt that they themselves could have avoided the accident by, for example, not going so fast, by watching and being more careful, by not fighting, or by avoiding the situation. This percentage varied with age, being about 25% for younger children and 35% for older children, suggesting perhaps a developmental influence in children's understanding of injury prevention. On the other hand, about half of the children perceived their accident to be attributable to some environmental cause outside of their control, notably, the actions of another child, or an object (e.g. rock, ball, playground equipment).

Morrongiello and Dawber^{112, 113} report a number of interesting studies which offer, *inter alia*, an explanation for the long-established higher injury rate experienced by boys rather than girls in playgrounds. Based on maternal responses to video-records of playground activities engaged in by children, they investigated whether there are any gender-based differences in a mother's

¹¹⁰ For example, M. Hillman, J. Adams and J. Whitelegg, 'One false move..... A study of children's independent mobility,' PSI Publishing, 1990. ISBN 0 85374 494 7.

¹¹¹ Research from the USA (S. A. Suecoff et al., 'A comparison of New York City playground hazards in high- and low-income areas,' Archives Pediatr. Adolesc. Medicine, 153, 363-366, 1999) also finds significantly more hazards per play area in low-income areas compared with high-income areas.

¹¹² B. A. Morrongiello and T. Dawber, 'Mothers' responses to sons and daughters engaging in injury-risk behaviors on a playground: implications for sex differences in injury rates,' J. experimental Child Psychology, 76, 89-103, 2000.

¹¹³ B. A. Morrongiello and T. Dawber, 'Parental influences on toddler's injury-risk behaviors: Are sons and daughters socialized differently?,' J. Applied Developmental Psychology, 20, 227-251, 1999.

response to seeing their child in an injury-risk situation. The authors conclude that mothers are in fact more tolerant and encouraging of risk taking by sons compared with daughters, and tended only to intervene with boys when more extreme types of risk taking were in evidence. Furthermore, mothers' verbal responses to risk taking varied between sons and daughters, sons receiving encouragement whereas daughters tended to be warned of consequences. These findings were not dependent upon the relative skills of the girls and boys, but appear to be solely linked to gender.

This raises serious issues. The authors suggest that reactions of parents to children's behaviours in injury-risk situations may, over time, produce enduring effects on children's beliefs about the desirability of risky behaviour and injury outcomes which, in turn, influence the likelihood of engagement in risky behaviour. Furthermore, the authors also find that for children who more regularly engaged in risky activities, or who had been injured before, mothers were even less likely to get involved. Elsewhere, Adams⁹⁰ has proposed that each individual behaves as if s/he has an individual 'risk thermostat' which determines which risks are taken and which avoided. The work of Morrongiello and Dawber infers that the setting of these 'thermostats' is, in part at least, determined by parents.

Not so far removed from this vein of research, Hart et al. have studied the effect of parental disciplinary styles on playground behaviour of 3 to 6 year olds.¹¹⁴ Parental styles are described as ranging from 'inductive' (using logical argument, rationales, explanation, and consequence description to establish behavioural limits) to 'power assertive' (e.g. physical punishment, threats, belittling, orders without explanation). Previous research has linked inductive discipline to greater self-control, improved communication skills, positive social interactions whereas power-assertive control has been related to child expectations of successful outcomes for hostile behaviour and to more aggressive childhood interactions with peers. The novel aspect of this research is to investigate the impact of these styles on playground behaviour (playground behaviour having already been established as a factor in many accidents).

The conclusions from this study are that preschoolers with more inductive parents exhibited less disruptive playground behaviour than children with power-assertive parents. The worst scenario appeared to be daughters of power-assertive mothers who engaged in less pro-social behaviour than anyone else. Overall, the findings support the hypothesis that mothers' disciplinary style is more consistently related to child outcomes due to their role as the primary caregiver and the main agent of socialisation, and regarding play in particular, that parental power-assertion is linked to higher levels of 'rough' play.

In an earlier study Boyce and Sobolewski¹¹⁵ arrive at some similar conclusions. Based on a study of 'accident-prone' children in American schools, they find evidence for a small group who sustain a disproportionate share of the overall injury experience. However, most of these children only experience the enhanced injury rate for a transient period, one possible explanation of which is the presence of short-term family-related stressors. The authors suggest that since particular schools appear to be associated with recurrent injury rates, strategies which deal with the environment may be appropriate. However, the study also highlights the need for more

¹¹⁴ C. H. Hart et al., 'Maternal and paternal disciplinary styles: relations with preschoolers' playground behavioral orientations and per status,' *Child Development*, 63, 879-892, 1992.

¹¹⁵ W. T. Boyce and S. Sobolewski, 'Recurrent injuries in schoolchildren,' *American J. Disease Control*, 143, 338-342, 1989.

extensive investigation of psychosocial and developmental influences on injuries and injury-associated behaviours.

6.2 ENVIRONMENTAL APPROACHES TO SAFETY

The preceding section provides clues suggesting that behaviour modification would be one means of reducing injuries, and one means of going about this could be by the provision of information or education. However, the effectiveness of information and educational programmes has seldom been rigorously tested,¹¹⁶ perhaps because this is difficult and often more expensive to carry out than the campaign itself. Alternative approaches are thus favoured by some authors, and include making changes to the physical environment, or passing legislation or standards. Sibert, for example, strongly advocates the use of environmental adaptations rather than education, and in the context of playgrounds recommends impact absorbing surfaces, slides on natural slopes that do not require ladders, and climbing frames that encourage horizontal rather than vertical play.¹¹⁷

A number of authors appear to start and end with the premise that safety can best be realised by focusing upon compliance with environmental or product standards. For instance, certain surface types are presumed as acceptable and others as unacceptable according to their compliance or non-compliance with standards, without further questions apparently being asked.^{118, 119} The simplicity of this approach appeals to many and has a considerable following in the play world and elsewhere where 'simple' remedies suggest themselves. Whether life is actually so simple is another matter. It is salient that many of the commonly-cited successful environmental adaptations, such as car seat belts,⁹⁰ and cycle helmets,¹²⁰ have been challenged or otherwise questioned by academic research at one time or another.¹²¹ Within this report the linkage between surfacing and safety has also been found to be less convincing than might have been supposed from the vehemence of some opinions.

6.3 BEHAVIOUR *versus* ENVIRONMENT

Perhaps the only firm conclusion which can be drawn from the above is that all opinions on what is good for play are, just that, *opinions*. To paraphrase Seedhouse, values drive opinions on what is good for (play) and not evidence.⁹² None of the evidence is absolutely definitive in the scientific sense, either for environmental remedies or for behavioural causes. It seems likely that, as with most 'nature versus nurture' arguments of this kind, the answer is, a bit of both.

¹¹⁶ B. A. Soby et al., 'Consumer attitudes to risk and the effectiveness of home and leisure safety campaigns in the European Community,' Research Report No. 15, Centre for Environmental & risk Management, University of East Anglia, 1993. ISBN 1 873933 30 4.

¹¹⁷ J. R. Sibert, 'Accidents to children: the doctor's role. Education or environmental change?' Archives of Disease in Childhood, 66, 890-893, 1991.

¹¹⁸ For example, M. T. Bond and M. G. Peck, 'The risk of injury on Boston's playground equipment and surfaces,' American J. Public Health, 83 (5), 731-733, 1993.

¹¹⁹ For example, S. K. Allen and R. R. Johnson, 'A study of hazards associated with playgrounds,' J. Environmental Health, June, 23-26, 1995.

¹²⁰ P. A. Scuffham and J. D. Langley, 'Trends in cycle injury in New Zealand under voluntary helmet use,' Accident Analysis and Prevention, 29 (1), 1-9, 1997.

¹²¹ S. Jarvis, E. Towner and S. Walsh, 'Accidents,' In: The Health of our Children: Decennial Supplement, ed. B. Botting, OPCS, HMSO, 1995. ISBN 0 11 691643 5.

One organisation that has embraced the concept of the environment at large having a beneficial effect, if properly and imaginatively constructed, is Learning Through Landscapes (LTL). LTL seeks to unlock the potential of school grounds through appropriate design, partnership, and parental and community involvement with a view to encouraging sport and fitness, emotional health and well-being, special needs, visual arts and citizenship. LTL's experience is that the maximum benefits of attitudinal and behavioural change in the school environment are achieved when young people and adults work together to enhance the environment.¹²²

¹²² Private communication, Joan Wood, Learning Through Landscapes.

7. ANALYSIS AND REVIEW

Summary of Main Points from this Chapter

- In comparison with other activities and locations, playgrounds in the UK are not, as sometimes implied, a hot bed of danger.
- This raises the question of why playground safety has been such a prominent issue. It seems plausible that the answer is that this particular risk has been 'culturally selected,' that is, chosen on the basis of factors associated more with the workings of society than with critical analysis.
- A key issue, which will always exist, is whether the benefits of the planned risks in playgrounds outweigh the inevitable accidents that result. The answer to this question lies in social values and not in science, engineering or risk assessment.
- The word 'safety,' as used by courts, professionals and the laity, has a number of distinctly different meanings. This is causing severe problems for play providers who are frequently placed in a no-win situation. This in turn can be seen to jeopardise play provision and play value, and perhaps other positive attributes of play which are largely ignored by the adversarial decision process as it currently operates.
- In the narrow view, the final proof of the effectiveness of safety measures can be measured by the rate of occurrence of injuries. Despite various interventions in the last decade there is a disappointing lack of evidence, either in the UK or the USA, of any significant trends at the national level. This does not mean that changes have not occurred, nor that useful things have not been done, but it does suggest that a more circumspect approach to the perceived benefits of proclaimed safety measures is warranted.
- From the research which has been done, the strongest evidence for a risk factor in playgrounds is that relating to equipment height, prompting several calls for height restrictions on equipment, usually of 1.5 metres. Yet the new European Standard (EN1177) permits equipment of up to 3 metres free fall height. This decision is not necessarily incorrect, however. The numerous parties involved were, no doubt, also deeply concerned about play value. A value-based judgement was necessary on where to draw the line between excitement and safety. However, the fact is underlined that playgrounds, even those complying with Standards, are by no means expected to be accident free.
- There is a fair degree of circumstantial evidence that play provision in the UK (and continental Europe), in terms of numbers of playgrounds and the quantity of equipment, has reduced and perhaps that playgrounds have been 'dumbed down' as a result of financial constraints and concern over litigation. This potentially threatens the positive attributes of play through lost opportunities for social and physical development, a less active and therefore less healthy life style, more

risk through children being displaced to places with more serious hazards, and not to mention less fun.

- The problem in striking a balance between the positive attributes of play and the negative ones is partly that the former are hardly measurable scientifically, whereas the latter are, at least to a degree. Thus, if it were mistakenly presumed that the decision process should be exclusively scientific, all of the positive attributes would be disregarded, being unquantifiable. Clearly, this does not lead to balanced decision making.

7.1 HOW DANGEROUS ARE PLAYGROUNDS IN THE UK?

As described in section 4.1.2, overall, 500 to 600 children die in the UK each year from accidental injury. Over the last decade to 1998, on average, certainly less than one per year of these cases is fairly attributable to playgrounds.

In terms of hospital attendances by children, of the order of or slightly less than 2% of those occurring each year from home and leisure activities can be attributed to equipment in playgrounds (i.e. 41,700 versus 2.25 million). The vast majority of these cases is not admitted or is admitted for a minimum period. Even head injuries are usually minor.¹²³

Crude estimates of the risk of injury per unit time of exposure in playgrounds from play equipment indicate this to be modest compared with the risk associated with many popular sports such as football, hockey, netball and cricket to which children will be aspiring, and in which they soon if not already will be encouraged, for health reasons, to participate.^{42, 45}

None of this information supports the notion that playgrounds in the UK are in fact 'dangerous' compared with the other risks of life. This does not mean that hazards cannot be identified on playgrounds. Clearly, they can. But many people believe that some at least of these 'hazards' are necessary since risky situations are part of the design intent of playgrounds. However, on the whole it appears that children are well able to cope with them, and the decision as to whether the balance between deliberately incorporated risk encounters and injury rates is reasonably set is a matter of social choice and not something which is resolvable by science alone.

7.2 WHY THE FOCUS ON SAFETY IN THE PLAYGROUND?

The safety of playgrounds in the UK has been under the spotlight for several decades. However, the findings, summarised above, do not themselves provide an explanation for why they have been afforded such a high profile. This raises the possibility of the involvement of perceptual factors. The psychologist, Slovic, who has investigated public perceptions of hazards of many kinds has demonstrated with abundant clarity that risk magnitude alone is by no means the only factor influencing the level of concern about a particular hazard. Other considerations arise, quite legitimately, such as trust, equity, voluntariness, nature of harm, uncertainty, et cetera.¹²⁴

¹²³ Ibid., and K. Lillis and D. M. Jaffe, 'Playground injuries in children,' *Pediatric Emergency Care*, 13 (2), 149-153, 1997.

¹²⁴ P. Slovic, 'Perception of risk: reflections on the psychometric paradigm,' 117-152, In 'Social theories of risk,' eds. S. Krimsky and D. Golding, 1992. ISBN 0 275 94317 8.

Moller, in his plenary address at the Fifth World Injury Prevention Congress in Melbourne in 1996,¹²⁵ also raises the issue of the culture of a society. As he says, the way in which a society or community conceives of safety issues has a major influence on what is investigated, pursued as a priority, implemented and even believed to be effective. "In any culture, some approaches to issues gain more credence than others. This can occur because of the dominance of a particular discipline or profession in a particular area, a significant success in dealing with a problem in a particular way when other approaches have failed, or just the development over time of a mythology which deems some methods to be effective even if they cannot be measured."

In the context of what is pursued (or not) as a priority, Moller cites gun control in the USA as an example. Prevention of gun-related death is not afforded the priority it clearly deserves (~5,000 American children per year are killed by this means³⁸) while lesser issues are pursued resolutely. In contrast, in Britain, with its different culture, gun-related child deaths were not tolerated following the Dunblane massacre. On the other hand, Britain has lagged behind other parts of Europe with respect to child pedestrian road accidents.¹²¹ There are many potential factors which might explain this. As Moller says, road safety has historically been the domain of the engineering profession, who have, naturally enough, sought engineering solutions, but engineering solutions alone are unlikely to be sufficient in dealing with complex situations involving human behaviour (the same may be true of playgrounds). More holistic solutions, involving planning and communities, have only more recently been on the agenda.¹²⁶ Furthermore, the meaning of 'safety' in the context of road transport planning in Britain is intimately linked with the use of cost-benefit analysis (CBA) which itself has certain implications for the numbers of deaths and injuries which might be tolerated. Of course, CBA is supposed to be used much more widely than the transport sector as a test of the viability of proposed safety measures – its use is widespread in Britain¹²⁷ and also the USA for example – but it is not always applied with the same purposefulness.

Thus, it may be speculated that the answer to the question as to why playground safety has been so high on the agenda in Britain is down to a combination of public and professional influences. Some of the public have campaigned on this issue,¹²⁸ the issue has been taken up by the media at times,¹²⁹ and it would appear that a number of professions have also elected to get involved. In this respect, professions may be trying to make up for perceived 'lost time,' since it is only in the last few decades that injury prevention has been recognised as a legitimate public health issue.¹³⁰ Overall, though, Moller's 'cultural influences' would appear to have been operative, the selection process owing more to prejudice¹³¹ than science.

¹²⁵ J. Moller, 'The culture of safety: a foundation for environmental and behavioural change,' Plenary Speech, 6th World Injury Prevention Congress, Melbourne, Australia, 1996.

¹²⁶ J. Adams, 'Risk and freedom: the record of road safety regulation,' 1985. ISBN 0 948537 05 1.

¹²⁷ HM Treasury, 'Economic appraisal in central government – a technical guide for government departments,' London HMSO, 1991. ISBN 0 11 560034 5.

¹²⁸ Some of these special interest groups are described in P. Heseltine, 'A playground safety campaign,' Proceedings of 'Playground Safety,' Penn State, 1995, 81-82, edited by M. L. Christiansen. ISBN 0 9650342 0 8.

¹²⁹ Readers may recall the Esther Rantzen campaign.

¹³⁰ As reported by Judith Green in 'Risk and misfortune,' University College London, 1997, injuries used to be regarded as random events whereas now they are regarded as predictable and hence theoretically preventable.

¹³¹ The use here of the word 'prejudice' is not meant to be derogatory, but simply to point out that people's beliefs and values have a huge influence upon the positions which are adopted.

7.3 WHAT IS THE MEANING OF 'SAFETY'?

As discussed at the end of Chapter 2, the answer to the question, “How many playground injuries are there?”, depends crucially on the interpretation of the words ‘playground’ and ‘injury.’ This same predicament exists with the word ‘safety,’ so much so that it is perhaps best avoided altogether, particularly in the context of activities like play and sport which can never ensure safety from harm and where the use of the word ‘safe’ will inevitably misinform someone.¹³²

Based on an analysis of the way in which risks from a variety of hazards have been contemplated by both professional and lay people, as revealed by numerous case histories drawn from injury control and wider afield, Table 18 provides a shorthand account of no less than eight approaches to managing risk which infer alternative meanings of safety. All are different, have disparate implications, and yet are operational in the UK at any one time.¹³³ All have been used, at one time or another, in the context of playgrounds. Consideration of this Table makes it clear that people, including professionals, have different things in mind when they talk about safety. For some, the implication of the word is no accidents (zero risk), whereas others would regard even thinking about this as naive if not foolhardy. For others, safety is defined either by: the achievement of targets; or by compliance with standards and codes of practice; or by achieving some pre-defined risk threshold; or by the use of economic tests such as cost-benefit analysis; or by the legal criterion of ‘reasonable practicability.’ The definition or path that is ultimately chosen by any person or organisation is not a matter of science but is a social choice.

As described elsewhere,¹³³ the diversity of perspectives makes life singularly hard for play providers. Most provision is by local government and education authorities. Being employers of more than the requisite five people, they are required by law to have recorded risk assessments of their activities (HSWA 1974), and to reduce risk until ‘as low as reasonably practicable’ (ALARP) – as listed in the rightmost column of Table 18. The meaning of ALARP originates from
formative

¹³² It is sometimes proposed that playgrounds should be proof against any amount of ‘serious’ harm as opposed to any harm at all. Unfortunately, this is not an achievable goal. Where harm can occur, there is always the potential for it to be ‘serious’ because the degree of harm depends on so many factors, some of which are beyond control and some which, if controlled, would require such stringent measures that the purpose of the activity would be undermined.

¹³³ D. J. Ball, ‘Ships in the night and the quest for safety,’ *J. Injury Control & Safety Promotion*, 17 (2), 83-96, 2000.

<i>Safety criterion</i>	<i>Zero risk</i>	<i>Safety targets</i>	<i>Standards, CoPs^a and guidance</i>	<i>Absolute risk</i>	<i>Risk factors</i>	<i>Risk assessment</i>	<i>Cost-benefit analysis</i>	<i>Risk tolerability and ALARP^b</i>
Typical adherents	Pressure groups	National and international agencies. Major industries	Traditional industries, lower courts, accident investigators	Actuaries and natural scientists	Epidemiologists and health scientists	Safety engineers and applied scientists	Economists	Higher courts, regulators, international agencies and major industries
Basis of approach	Commitment	Political desire	Expert judgement	Historical data	Evidence	Scientific simulation	Utility theory	Case law (in the UK)
Strengths	Simplicity, single-mindedness	Clarity of overall policy goal	Should reflect a broad swathe of expert opinion. Tested over time	Enables insurance companies to set premia	Scientific basis	Analytical tool. Ability to forecast the unknown	Considers both costs and benefits of safety measures	Considers wider implications of safety measures including cost and practicability
Limitations	Associated benefits foregone. Cost of control disregarded	Top down approach which may be inconsistent with the sum total of individual safety interventions	Validity and motivation of judgements unclear. A bottom up approach potentially inconsistent with policy.	Other social priorities are disregarded	Uncertainties, causality, and the question of 'how safe is safe enough?'	Uncertainties in assumptions, probabilities and dose-response functions	Anchored in a particular philosophy. Hidden assumptions. Methodological problems, particularly in valuing benefits	Difficulty of striking a balance between competing attributes of a decision
Examples	'Vision Zero', hand gun control (UK), machinery guards, food additives	Injury targets. Air quality guidelines. Sustainability	Product safety standards. Work CoPs. Numerous personal injury court cases	Simple comparison of risks from different activities	Public exposure to radon and air pollution, playground safety	Occupational safety assessment	Railway and offshore safety investment decisions and major hazard control	Major hazard control, strategic planning applications

Table 18: Eight different concepts of 'safety' with an indication of their origins and predominant professional affiliations.¹³³ An attempt has been made to present these as a spectrum, with more politically-inspired or value-driven approaches on the left, with more science-based approaches in the centre, and with more pragmatic hybrids to the right. These divisions are not, however, clear-cut. ^aCodes of Practice; ^bAs Low As Reasonably Practicable

case law in the UK and implies a weighing up of the effectiveness of safety measures in reducing risk against the costs and difficulties (and any other relevant factors) of their implementation, prior to any decision about whether or not to go ahead.¹³⁴ The purpose of this is to ensure that sensible risk control measures are implemented, but also that money and resources are not wasted, also a key consideration for public bodies.¹²⁷ However, strategic-level safety decisions on the basis of ALARP are not necessarily going to lead to the same conclusions as safety decisions made by adherents to the other approaches listed in this Table. Thus, although everyone is interested in promoting 'safety,' the fact that the basis of decision making is incoherent typically leads to confusion and potentially to conflict as well.

For example, when the inevitable injuries occur and litigation is entered into, there is a strong tendency for lower courts, and some of the experts who advise them, to rely solely upon comparison of accident circumstances with whatever standards or published advice can be found as a measure of culpability, and in so doing to ignore more strategic risk management issues. As the former Director General of the HSE has said; "Fundamentally the attitude comes from the courts, who, in settling compensation, are over-impressed with the event and too little impressed by any precedent risk and benefit equation."¹³⁵ The paradox is that standards and advice in many cases are not based upon risk assessment or considerations of practicability. In fact, they are usually largely the domain of 'industry and trade, and with (only) a modest input from consumer representatives.'¹³⁶ There is, furthermore, a feeling in some quarters that industry-based standards may be more or less strict depending on a host of factors including the use of anecdotal evidence and narrow commercial interests.¹³⁷ So, while an agency responsible for a number of hazards may have done everything that was reasonable in the way of identifying hazards, measuring risks, and adopting practicable solutions, all fully in accord with the higher level definitions of safety and even pivotal case law, it may still fall foul of procedures which assign highly literal interpretations to advisory documents and this may well be judged a sufficient test of negligence by a lower court.

The disturbing feature of this is that authorities with strategic responsibilities can be deterred from exercising that responsibility by a powerful culture which is used to relying almost exclusively on judgement (though they may be unaware of it) and hardly if at all on properly-conducted scientific evaluation which is of course an essential aid for policy formation at the strategic level. Instead, responsible authorities are encouraged to adopt what may be purely value-based recommendations that constitute no more than talismans for warding off potential litigation. Yet, while science and risk assessment certainly do not have all the answers, most would probably agree it is churlish if not irresponsible to disregard them in their entirety. The danger must exist that failure to critically assess the effectiveness of proposed safety measures, before and after implementation, by whatever means are available, increases the risk of more harm rather than less, and constitutes a

¹³⁴ J. Le Guen, Health & Safety Executive, 'Reducing risk, protecting people,' HSE Books (December 2001); or D. J. Ball, 'Risk management,' in Kempe's Engineers Year-book, 2157-2183, 2001. ISBN 0 86382 485 4.

¹³⁵ J. Rimington, 'Coping with technological risk, a 21st Century problem,' Royal Academy of Engineering, 1993.

¹³⁶ W. Rogmans, 'Europe signposts a safer world: the way ahead for consumer safety in Europe,' Int. J. for Consumer Safety, 4 (4), 215-221, 1997.

¹³⁷ P. Heseltine, 'Safety versus play value,' 91-95, Proceedings of 'Playground Safety,' Penn State, 1995, edited by M. L. Christiansen. ISBN 0 9650342 0 8.

potential waste of public and private money, not to mention the large volume of research now undertaken in the interests of injury prevention.

7.4 THE EFFECTIVENESS OF SAFETY MEASURES

During the last decade or two there has been significant expenditure by play providers in the interests of play provision and safety. The ultimate test of whether these measures are paying dividends should manifest itself in a decline in the numbers of injuries arising. As described in Chapter 2, there is no discernible national trend in overall cases, either down or up, over the twelve year period from 1988 to 1999. This does not mean changes have not occurred, for one thing, there is no reliable measure of exposure (the number of children using playgrounds may have changed), and for another, all data bases are themselves subject to uncertainties and changes over time which tend to mask trends. On the other hand, a similar situation apparently pertains in the USA.

Tinsworth³¹ reports on playground equipment-related injury trends from 1990 to 1998, the purpose being to assess the need for further actions, over and above those already implemented in the US, to address playground hazards. Her investigation of the numbers of cases found that there appeared to be no consistent trend in injuries, only marginal and possibly spurious changes in age-specific injury rates, no change in body parts affected or injury types, no trend in the numbers of hospital admissions, and no trend in the types of equipment involved. Overall, her conclusion is that despite a variety of actions having been taken, major trends in injuries cannot be identified.

Although these findings are subject to the same caveats as the UK data, they are nonetheless disappointing and one is obliged to consider the possibility of other explanations. For example, that safety measures are less effective than might have been hoped; that children (or their guardians) use playgrounds in such a way as to circumvent safety measures; and so on.

Disquiet over the effectiveness of safety measures, even those which are vaunted, is not confined to playgrounds of course. Scuffham and Langley, for example, carried out a detailed statistical analysis of trends in cycle injuries in New Zealand under voluntary helmet use.¹²⁰ Their conclusion was as follows: "What is clear from the findings...is that cycle helmets are not achieving the gains which were expected of them. Why this is so is a matter for speculation but clearly those involved in promoting this strategy need to consider how to improve their effectiveness." Elsewhere, Viscusi warns that in general technological remedies for safety problems may induce a 'lulling' effect on consumer behaviour which has the effect of undermining their potential.¹³⁸ In considering safety interventions, it is necessary to consider how they will be perceived by the public and whether this might result in shifts in behaviour which restore the risk to its original level or even, conceivably, make it bigger. Likewise, Jarvis et al. warn that "Unintentional injury in childhood is a major problem which has probably changed very little in frequency over the last twenty years. Most of the current data we have about the causes of these injuries is almost impossible to apply in preventive campaigns. Very few of our present interventions, intended to prevent injuries, are actually known to work."¹²¹

¹³⁸ K. W. Viscusi, 'Fatal tradeoffs: public and private responsibilities for risk, Chapter 13.4, Oxford University press, 1992. ISBN 0 19 507278 2.

To read the literature on playground safety leads to the unavoidable impression that a good number of authors have prior beliefs about the effectiveness of remedial measures irrespective of the quality or quantity of evidence. For example, enormously strong views are held about the utility of impact absorbing surfacing as a risk reduction measure. According to Frost,¹³⁹ the prevailing view is that provision of shock absorbing under-surfacing under and around playground equipment and designing “fall-free” equipment is the most important variable in playground safety. Henderson is yet more vehement – “Shock absorbency is the *sine qua non* of playground surfacing. Surfacing which does not offer adequate shock absorbency should not be used under playground equipment no matter what other advantages it may offer.”¹⁴⁰ These remarks were made over half a decade ago when hardly any of the research in Table 17 was available. Even to this day the evidence is mixed.

As Moller has pointed out, the way in which a society or community conceives of safety issues also has a major influence even upon what is believed to be effective.¹²⁵ Such influences pervade many sectors of society. The philosopher, Seedhouse, has written mainly in the context of health promotion, but his work is readily transferable to injury prevention. According to Seedhouse, the answer to the question “what drives health promotion – evidence or values?” is strongly tilted towards “values.”⁹² Not that this is necessarily harmful in itself, because all things should ultimately be driven by values. However, values derive from prejudice and this may come in different forms – necessary prejudice, blinkered prejudice, and reasoned prejudice. As Seedhouse says, only the first and third forms ought to be countenanced by health promoters.

In section 4.2 of this report the scientific evidence on playground risk factors was brought together. From this information, the most consistent evidence is for *equipment height* as a risk factor. It would appear that risk of injury increases fairly steadily with height of equipment, probably by about two or three times for average heights of greater than 1.5 metres compared with average heights below that. As noted in Chapter 4, this has led quite a number of scientific investigators to call for height restrictions on equipment, usually of 1.5 metres, but even, apparently, down to 0.5 metres in some instances.¹⁴¹ In view of the scientific evidence, it is of considerable interest to note that the new European Standard (EN 1176-1:1998) permits free fall heights of up to 3 metres. The evidence tells us that at these heights, irrespective of the surface beneath, the probability of injuries can be expected to be greater. A conclusion which might be drawn from this is that the numerous parties involved in the promulgation of the European Standard had other things on their mind, for example, play value. As Richter has said, “behind “play value” comes – measured in terms of importance for the children – once again play value and then again play value and perhaps then the concern about safety.”¹⁴² Play value, of course, is not something which is easily measured, certainly by the methods favoured by science as developed in western cultures, and tends therefore to be discounted by health practitioners and safety experts when contemplating risk factors. This, perhaps, accounts for some of the dissent.

¹³⁹ J. L. Frost, ‘Analysis of playground injuries and litigation,’ Proceedings of ‘Playground Safety,’ Penn State, 1995, 65-72, edited by M. L. Christiansen. ISBN 0 9650342 0 8.

¹⁴⁰ W. J. Henderson, ‘Resilient playground surfaces – choices for US playground administrators,’ Proceedings of ‘Playground Safety,’ Penn State, 1995, 73-80, edited by M. L. Christiansen. ISBN 0 9650342 0 8

¹⁴¹ As reported by P. Reed, ‘How safe is safe?’ Proceedings of ‘Playground Safety,’ Penn State, 1999, edited by M. L. Christiansen. ISBN 0 960342 1 6.

¹⁴² J. Richter, ‘Proceedings of ‘Playground Safety,’ Penn State, 1995, 139-142, edited by M. L. Christiansen. ISBN 0 9650342 0 8.

On the other hand, European Standard EN1177 does recommend the use of impact absorbing surfaces around equipment even though the evidence assembled here for surfacing is less convincing than that for height as a risk factor, though, given the difficulty of these studies, probably indicative of some benefit. However, whether this risk reduction benefit is sufficient for safety surfacing to meet the ALARP criterion appears highly dubious,^{2, 143} even if an enhanced value of safety of £2M to £3M were used¹⁴⁴ (more commonly, safety investment in the UK is assessed against a valuation of life of ~£1M¹⁴⁵). Thus, unless other benefits could be assigned to these products (and no detriments), they would appear not to satisfy simple cost-benefit criteria (for a fuller analysis see Appendix C).

7.5 THREATS TO PLAYGROUNDS

The story, as it has unfolded, points to a number of threats to playgrounds, and hence children, which need to be taken very seriously. These come in several forms.

First on the list, and certainly amongst the most important in terms of priority, is the threat to *play provision*. Firm data are difficult to come by, but anecdotal evidence, based on observations by experienced local authority officers, play consultants, and industry representatives in the UK and Europe, suggests that the number of facilities has declined in at least some areas during the last decade.¹⁴⁶ Factors that appear to be driving this trend include, notably, cost and liability considerations. Olley, of Norwich City Council, stated in 1996 that he believed that play provision across the country was generally declining although several local authorities were trying to slow the trend.¹⁴⁷ Heseltine of RoSPA concluded as follows, “In the UK the cost of surfacing has resulted in equipment being removed, playgrounds closed and only small amounts of items purchased for new playgrounds – and all without much evidence that it is effective in reducing any accidents other than the extremely rare direct head fall.”¹³⁷ Sutcliffe also notes a reduction in play equipment which he attributes, in part at least, to local authority budgetary problems caused by the introduction of a succession of new Standards at times of financial constraint, coupled with increasing amounts of litigation following playground accidents.¹⁴⁸ From a European perspective, Jensen in Denmark has reported that, “Numerous playgrounds are being dismantled (in some cities more than 50%) due to the cost of retrofit and maintenance required to obtain insurance coverage. Getting rid of certain categories of equipment is already common practice. This is not necessarily because they are dangerous, but simply because they belong to a category of equipment where specific types or brands have proven to cause injuries. This is not just happening to a particular category of equipment, but to all!”¹⁴⁹

¹⁴³ D. J. Ball, ‘Applying risk management concepts to playground safety,’ Proceedings of ‘Playground Safety,’ Penn State, 1995, 21-26, edited by M. L. Christiansen. ISBN 0 9650342 0 8

¹⁴⁴ D. J. Ball, ‘Consumer affairs and the valuation of safety,’ Accident Analysis and Prevention, 32, 337-343, 2000.

¹⁴⁵ S. Chilton et al., ‘New research results on the valuation of preventing fatal road accident casualties,’ 28-33, in Road accidents Great Britain, 1997 Casualty Report, UK Government Statistical Service, HMSO, London, 1998. ISBN 11 552068 6 0.

¹⁴⁶ This view is also confirmed by members of the Play Safety Forum.

¹⁴⁷ C. Olley, private communication, 28 March 1996.

¹⁴⁸ R. Sutcliffe, ‘Does the playground equipment market reflect the health of our national culture?’ In: Building for Leisure, 1996.

¹⁴⁹ M. T. Jensen, ‘CEN...and the art of motor-skill maintenance,’ Proceedings of ‘Playground Safety,’ Penn State, 1995, 109-115, edited by M. L. Christiansen. ISBN 0 9650342 0 8

Of course, reduction in play provision is not necessarily detrimental if it is done in a planned way, but the anxiety exists that the kinds of closures referred to by the above authors were not generally of this kind. In this case, reduction in provision is potentially harmful in two ways. One is that it deprives children of the social, psychological and developmental opportunities provided by playgrounds. The other is that children will be displaced to play in other areas which may be more dangerous, for example, anywhere in the vicinity of traffic. Risk transfers of this kind are not easily proven, but some preliminary evidence of this phenomenon is described in Chapter 5.⁹⁶⁻⁹⁸ As noted in section 7.1, in the UK the proportion of all childhood accident fatalities and injuries which occur in playgrounds is very small – so there is certainly the potential for more children to be injured were they displaced to spend their time elsewhere. Graham and Wiener¹⁵⁰ provide an eloquent warning of the kinds of unanticipated (and undesirable) side-effects resulting from a very wide range of narrowly-conceived health and safety interventions (i.e. risk management decisions). These side effects, in technical jargon, are called risk trade-offs, although they are equally described by far more familiar maxims such as ‘the cure is worse than the disease.’

As these American authors say of risk management interventions, “Despite the record of successes (and some failures) in reducing risks, we suspect that risk tradeoffs are quietly hindering the effectiveness of the national campaign to reduce risk. The campaign to reduce target risks may in effect be at war with itself: it may be clearing away target risks but creating a new crop of countervailing risks.”¹⁵⁰

“Writ large, the implications of risk trade-offs are potentially quite grave. First, we may be getting much less protection from risk than we expect. Medical treatments, products, and government regulations may be protecting people and the environment less than advertised and less than needed – and might even, in some cases, be doing more harm than good. Second, the credibility of the entire social movement for protection against risk could be at stake. Unless risk tradeoffs are acknowledged and addressed forthrightly, the national campaign to reduce risk may ultimately come to be viewed as oversold, or even viewed with a cynicism that forfeits its legitimacy and public support.”¹⁵⁰

Graham and Wiener cite many examples of risk trade-offs. To mention, by way of illustration, just one, the requirement to put child-safe caps on medicine bottles appears to have led to an increase in poisonings from some medicines in the USA. This was attributed to a ‘lulling’ effect which the caps had on parents, leading them to, for example, not bother to lock the entire medicine cabinet.¹³⁸ One can only speculate about what the effect of a perception of supposedly ‘safe’ playgrounds might have had upon parents and their children in terms of these kinds of behavioural compensatory mechanisms, but it does not take much imagination to realise that it could have acted in such a way as to diminish any positive benefits which might have been associated with the alleged safety measures, so offering one possible explanation for their apparent failure to generate any change in the toll of injury cases.

The second source of threat, and which some might actually consider the most important, has to be the effect of playground design, equipment design and safety interventions upon *play value*. This is important for several reasons. First, of course, is the fact that play value is the reason why playgrounds exist. Consequently, any proposed interventions, safety or otherwise, which might seriously impinge upon play value should be evaluated from this perspective prior to

¹⁵⁰ J. D. Graham and J. B. Wiener, ‘Risk versus risk – tradeoffs in protecting health and the environment,’ Harvard University Press, 1995. ISBN 0 674 77304 7.

recommendations for their implementation. Failure to do this is bad decision making, falling as it does into the trap of being narrowly-based and unwary, as described by Adams,⁹⁰ Graham and Wiener,¹⁵⁰ and many others.¹⁵¹ Second, although play value is not easily measured, one of its dimensions is almost certainly the interest the activity holds for children. Loss of interest is likely to be important, *inter alia*, because children then spend their time elsewhere, possibly engaged in more dangerous activities. To use a popular though ugly expression, the potential for ‘dumbing down’ of playgrounds needs to be watched for carefully. Furthermore, effects of this type may be age-dependent. For instance, there is a view that 13 to 16 year olds may have been neglected in particular.¹⁵² It can be imagined that ‘emasculated’ equipment, if such existed, would certainly displace this age group who would seek out their thrills elsewhere, as in, for example, skate boarding.¹⁵³ Third, there is a view that risk is important in playgrounds and should form an intrinsic component. As recorded in ‘Best Play,’ “Play is a key element in children learning to appreciate, assess and take calculated risks, which is fundamental to the development of confidence and abilities in childhood. Children seek out opportunities for risk-taking and it is the responsibility of play provision to respond with exciting and stimulating environments that balance risks appropriately.”¹⁵⁴ This is by no means a unique position, many others having written of the central importance of risk in play. Druck, for example, describes how the (US) play industry has been guided over the last two decades by professionals concerned with accident prevention, to the detriment of interactive play, and with inadequate discussion of the essential role of risk in play.¹⁵⁴ Stutz advises that; “If children learn to take risks in small situations, they are not so likely to get involved in serious ones later, because they have learnt through experience what to expect and how to look after themselves. A grazed knee from falling down, a splinter in the finger, a twisted ankle, even a green-stick fracture of the arm when young, are a small price to pay for learning to assess real-life situations and take the necessary precautions.”¹⁵⁵

As noted, play value is not easily measured, but numerous professionals in play provision have been prompted to express their concerns about what they suspect are signs of its erosion. For instance, Heseltine, who has perhaps visited more British playgrounds than anyone else, reports that: “Last year we did a playground quality exercise for an urban area – the playgrounds were excellent on safety, construction and maintenance. They met all the relevant standards – and were totally useless in terms of play and child development.”¹³⁷

Many others warn about the influence of the litigation process upon play which they believe has had enormous effects upon designers and manufacturers through trying to make playgrounds ‘accident-proof’,¹⁵⁶ a notion which is, of course, patently absurd, and through promoting the

¹⁵¹ For example, A. L. Dorris and M. F. Tabrizi, ‘An empirical investigation of consumer perception of product safety,’ *J. Products Liability*, 2, 155-163, 1978.

¹⁵² J. Wenger of NPFA is of the view that on the whole children above 10 years of age do not any longer see playgrounds as made for them.

¹⁵³ Any parent who has seen a skate boarding video will appreciate the risks of serious injury posed by this activity. But the need for this kind of risk taking appears to be a powerful component of youth culture.

¹⁵⁴ F. Druck, ‘The importance of a universal design approach to interactive and therapeutic play,’ *Proceedings of ‘Playground Safety,’* Penn State, 1999, edited by M. L. Christiansen. ISBN 0 960342 1 6.

¹⁵⁵ E. Stutz, ‘Rethinking concepts of safety and the playground: the playground as a place in which children may learn skills for life and managing hazards,’ *Proceedings of ‘Playground Safety,’* Penn State, 1999, edited by M. L. Christiansen. ISBN 0 960342 1 6.

¹⁵⁶ T. Jambor, ‘Coordinating the elusive playground triad: managing children’s risk taking behavior, (while) facilitating optimal challenge opportunities, (within) a safe environment,’ *Proceedings of ‘Playground Safety,’* Penn State, 1995, 103-108, edited by M. L. Christiansen. ISBN 0 9650342 0 8

purchase of stereo-typed equipment by schools and councils justifiably fearful of litigation in view of the proliferation of law suits which has occurred in some countries.¹⁴¹

The third threat to be described here is that of the example being set by the present system. As it now exists, any accident in a playground is potential fodder for the legal process. Concepts such as 'play value' and the desirability of risk appear alien to the courts which deal with these cases, and instead playgrounds are generally treated the same as work places in that all risks are supposed to be eliminated (subject, of course, to the caveat, 'so far as reasonably practicable,' although this also appears to be unfamiliar territory in many lower courts despite it being the central concept of the Health and Safety at Work Act 1974). In these courts, the 'elimination of risks' is usually assessed on the basis of compliance with standards. Thus, following an accident in a playground, the usual expectation is that an engineer will be appointed to carry out detailed dimensional measurements. While this has some merits, it can be carried too far. In reality, standards are founded substantially on value judgements, some of which are not even driven by safety. As Heseltine has said, "it is remarkable how casual anecdotal evidence, crude accident trends, and narrow commercial interests....without a clear understanding of accident causation,"¹³⁷ affect the development of standards. Looked at objectively, the fixation upon precise numerical measurement can be seen to be endowing some magical quality upon the numbers which has in many cases rather little justification in reality. This is not entirely a harmless process, for it implies that the required intellectual process of striking an appropriate balance between risks and benefits of play is replaced by a purely mechanical process of measurement and comparison which may have little connection with actual policy goals. Such behaviour is bound to create a lasting impact upon children who are involved and their impressions of the world, as it will on parental attitudes.

7.6 THE PROBLEM OF BALANCE

A major difficulty for play is that its universally-recognised positive attributes are hardly measurable scientifically. It is hard to quantify scientifically the fulfillment of 'a child's right to play,'¹⁵⁷ though few would dispute its legitimacy. It is also hard to measure the psycho-social and developmental benefits of play, whether or not it enhances creativeness or a healthier life style in later years, or even its potential for enabling children to learn about how to handle risk. It is difficult to prove that the provision of playgrounds lowers total risk to children by moving them away from more dangerous places and activities. Thus, whereas the benefits of play are mainly assessed qualitatively at best, the disbenefits are measured in terms of cost of provision, injuries, law suits and the like, and are far more tangible.

Achieving a balance between tangibles and intangibles is difficult and, particularly in a science-dominated culture, is in singular need of human intervention and judgement. No mathematical formula could ever solve this conundrum. The predicament is summed up by Seedhouse:

"Priorities are set on the basis of technical criteria and not on less tangible priorities which frequently are what count for people. This is a deeply cultural problem. The failure is not down to a lack of money or resources, but to a failure of sense of purpose and lack of vision."¹⁵⁸

¹⁵⁷ UN Convention on the Rights of the Child.

¹⁵⁸ D. Seedhouse, presentation on the meaning of dignity in health care, Middlesex University, 4 June 2001. Note: although dignity in health care has little obvious connection with playgrounds, the associated problems are remarkably similar.

Thus, the situation in which children's play finds itself is summarised by Figure 5. An interesting point about Figure 5 is that, despite the fact that dis-benefits are all too real in comparison with benefits, *both* sides of the balance are weighted by value-based commodities.

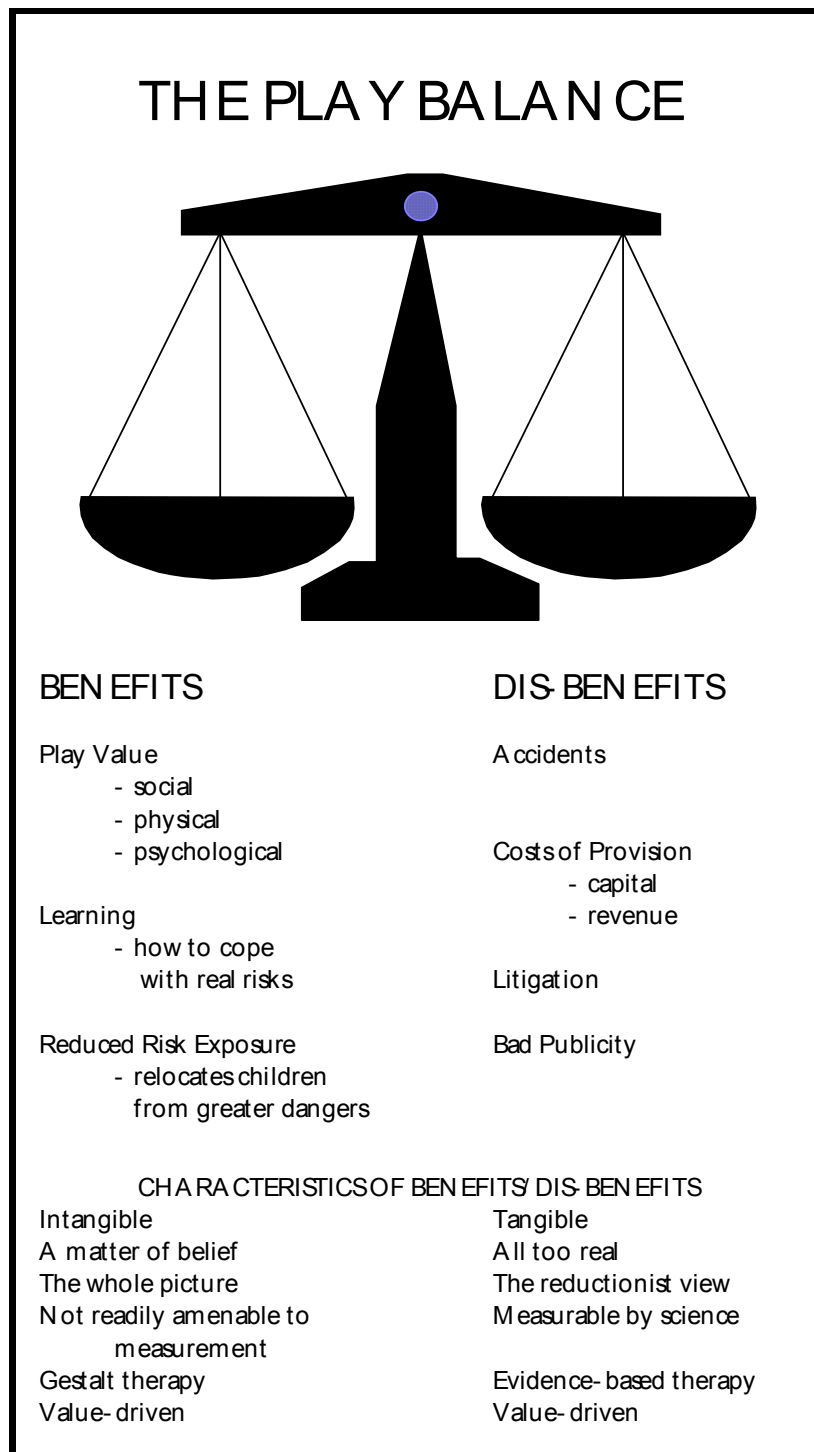


Figure 5: A simplified illustration of the problem facing play providers. On the one hand, all the good things about play are hard to measure, whereas the bad things - accidents, costs, litigation - can be measured by science and other quantitative tools and are all too real. Faced with this situation, and children's lack of political muscle, the tendency will be for benefits to be undervalued and play provision to lose out.

8. CONCLUDING DISCUSSION AND RECOMMENDATIONS

This Chapter contains the final discussion from which a number of recommendations emerge. These recommendations are necessarily not more than tentative, because they are based upon the author's own assessment of the information inevitably combined with a value system based on personal experience, knowledge and beliefs. It is a matter for the appropriate agencies concerned with children's play in the UK and the regulator to decide which, if any, to pursue.

8.1 THE KEY ISSUE IS BALANCE

Playground providers in the UK have had a torrid experience for many years, partly because playgrounds have been selected as a campaign issue by a number of groups with varying degrees of justification, partly because an unrealistic expectation has developed over the level of safety which is achievable, and perhaps also because of the surprisingly large number of professional and lay interest groups whose interests are not entirely in tune. This burden has been increased by a growth in litigation, a good deal of which can probably be classified as 'speculative.'

The resulting threat, however, is not solely borne by play providers. Loss and emasculation of play facilities, which is an almost inevitable response to this onslaught, deprives children of their recognised right to play, deprives them of perceived important developmental experiences including ability to handle risk, and may in fact place them at greater risk overall by displacing them to more dangerous places and activities. It also diverts attention and resources from more important child safety issues, and may deter some agencies from providing any facilities at all for children because of concerns that they too might lead to similar problems. Skate parks, for example, for which there is a big demand, are fairly rare and one can imagine that provision of such might be seen as inviting trouble even though failure to provide displaces would-be skaters onto the streets.

In marked contrast to the concern over safety on the playground, the evidence gathered here suggests that the crucial societal problem of playgrounds and their provision relates less to safety of playgrounds *per se*, than to the issue of how to realise for children the full range of social, physical, emotional and cognitive benefits associated with play (one of which is considered to be the learning experience gained from exposure to modest risk). Second to this is the issue of how to balance these positive attributes against the inevitable risk of injury which any activity, including play, generates.

The problem of achieving this balance, which is in everyone's interest, is compounded because different groups in society tend to pursue single-mindedly their own particular interest and way of doing things, with relatively little recourse to the wider perspective. Take the different ideas of what constitutes 'safety,' as described in Table 18, and pretty well all of which impinge upon playground provision, and couple this with the muted voices of those whose primary concern is the benefits of play, and this leads inevitably to a system which is driven, not by expressed choice, as in a proper decision process, but by the machinations of social forces such that whichever comes out on top is the victor. This does not necessarily have anything to do with the rights of children, optimisation of play provision, or provision of a balanced resolution to the clearly strongly-held and diverse opinions which exist on play value and safety. Yet, it is probably true to say that what most unites all perspectives is interest in children's welfare, and

what differentiates it is simply what is taken into consideration in planning how this is best achieved.

For example, for some, the way ahead is by the application of scientific research into injury prevention in the western tradition. This is second-to-none for dealing with certain specific quantifiable issues, of which injury statistics provide a relevant case, and some valuable insights have been gained in this regard by the injury prevention community. On the other hand, the approach is weak when it comes to qualitative issues, for instance, anything associated with play value, and is of no help at all in dealing with human values and preferences.

The split is not unlike that found in the contrast between western, evidence-based medicine, and eastern, traditional medicine, the one focusing upon a specific condition and the other attempting to look at the whole body (reductionism versus Gestaltism). Graham and Wiener, in talking about risk tradeoffs in general, say essentially the same thing when discussing the need for “a more holistic paradigm with which decision makers would “treat the whole patient” instead of confining their thinking to bounded fragments of larger systems.”¹⁵⁰

As described earlier, Moller has also observed how cultural factors influence the way in which risks are perceived.¹²⁵ In fact, there is a particular sociological theory, known as Cultural Theory (CT), which provides a fuller explanation of the origins of such contrasting views (for a brief account of CT, and its application to play provision, see Appendix D). These analyses all suggest that in order for balance to be maintained in decision making, overly fragmented decision making processes need to be replaced with, rather, a “whole patient” outlook.

Perhaps the most prominent source of narrow decision making is the so-called absent voice. In other words, if affected parties are absent from a decision process, there is a tendency for a disproportionate weight to be assigned to the organised interests. In these situations, the benefits to a decision maker of acting against a strongly expressed concern, say, a perceived playground hazard, may be largely defined by the support or mollification of key constituencies clamoring for such action. The decision maker is less likely to take account of any losses associated with the intervention which are imposed upon constituencies not participating in the dialogue, say, those concerned with the benefits of play.¹⁵⁰

Although clearly a matter of opinion, the impression of this author is that during the last decade or two, the safety community (hierarchists in Appendix D) has had by far the strongest voice in the playground debate (you might say, they are better organised and have done their job the best), arguably followed by the individualists (commercial, legal interests et cetera) who are usually able to look after themselves. Less prominent has been the egalitarian perspective which would have a natural inclination to seek a less rule bound resolution of the matter with far more emphasis on the realisation of play benefits. Almost absent from the debate has been the voice of children who have, as is well known, no votes and consequently negligible lobbying power.

Recommendation 1: *More emphasis should be given to incorporating views on the aims of children’s play and to realising the many positive, qualitative characteristics of play which are perceived by the play community, in planning the play environment. This can be helped by ensuring that absent or muted voices which represent these wider interests are strengthened and included in the debate, which should not be dominated by any single sectorial interest.*

8.2 SAFETY ON AND OFF PLAYGROUNDS

Another strategic issue requiring consideration is the risk tradeoff problem, also described by Graham and Wiener¹⁵⁰ and others, as it applies to playgrounds. As reported in section 5.3, there is some research indicating that provision of playgrounds, despite these having their own inherent risks, may improve child safety overall because it draws them away from more risky environments. Certainly, the potential for a multiplying effect cannot be denied, with as many children being killed in accidents off playgrounds in one average year as in a thousand or more years on UK playgrounds even as they have stood over the last decade (section 7.1).

The risk of relocating children to these less safe environments through the inadvertent dumbing down of playgrounds, or reduction in provision over economic considerations or safety fears, warrants at least as much consideration as does the safety of playgrounds themselves. This can only be tackled by taking a more strategic overview of play provision in the community and child safety overall. Specifically, tools such as risk assessment should be applied on a district, regional or jurisdictional basis by the appropriate duty holders as a means of aiding prioritisation and decision making. The current most prevalent procedure, of using risk assessment as a tool simply at the level of the playground or an individual piece of equipment, does not necessarily add up to a sensible strategy at the regional or strategic level (just as various local recycling measures do not necessarily add up to global sustainability). Likewise, more attention should be paid to the effect of safety interventions on childhood risk overall, both on and off the playground.

Recommendation 2: *To avoid the problem of risk transfer, and to optimise child safety overall, the pursuit of safety on playgrounds should be conducted in conjunction with a parallel programme of risk assessment dealing with the strategic aspects of play provision and with child safety in the wider community.*

8.3 SAFETY ON PLAYGROUNDS

Despite the fact that the safety record of UK playgrounds is surprisingly good, especially in view of what children do there, the topic has remained controversial for several decades and may well continue to be so given attempts by some in the legal profession to generate more business from accidents. Legal actions following accidents on playgrounds constitute a thorn in the flesh of play providers. While, no doubt, some claims are warranted, due to poor maintenance or other failings, others are not.

One problem appears to be that safety on the playground is perceived in some quarters as the sole responsibility of the provider and that if something bad happens it is necessarily attributable to inadequate provision. The problem is compounded by some court experts who can all too easily find an advisory document which in some way or another has been breached. As Sapolsky has said: “There is no shortage of advice about risks. Let a potential risk be identified and soon all possibly relevant professions, agencies, and trade groups will offer public positions in order to protect established interests or proclaim new ones. Add the news appeal of risk stories, the availability of advertising dollars to defend and promote products, and the ongoing flood of scientific reports and there is a flood of guidance for the concerned.”¹⁵⁹ Indeed, it is probable that

¹⁵⁹ H. M. Sapolsky, ‘The politics of risk,’ *Daedalus*, 119 (4), 83-96, 1990.

there is no place in the world which complies with all published advice, some of this being, in any case, inconsistent, ill-conceived, not transferable from one circumstance to another, or motivated by factors unconnected with safety.¹³⁷ What can be done about this? Clearly, it has to be something fundamental. After several decades, tinkering is not going to bring about a change in perception sufficient to alter this situation.

A possible strategy is for the leading bodies dealing with play in the UK to make a concerted effort to redress the balance by propagating more widely the inherently risky nature of play, and the perceived benefits of exposure of children to identified and obvious risk. So, whereas at present there is a tendency to talk of safety or safe play, which is potentially misleading, as an alternative, playgrounds could be described as places where risks will be encountered.

The possibility also exists that playgrounds could be graded in terms of riskiness. For instance, those with higher and more adventurous equipment getting a higher risk rating. One advantage of this approach is that there is no pretence, intentional or otherwise, that playgrounds are risk free. This might act as a reminder to guardians that they too can contribute to reducing childhood risk on playgrounds if they consider it necessary. After all, guardians know their children's capabilities best, and no two children are alike (see also section 6.1 and footnote 40). Second, this provides greater scope for playgrounds to exhibit different levels of challenge, possibly sufficient in some cases even to win back some younger teenagers who have opted for far more risky activities due to the real or perceived absence of excitement of present-day playgrounds. Third, courts would be more likely to think in terms of the balance being struck between risk and play value if this situation were overtly the case, rather than as at present in which the criterion of 'foreseeability' is applied, often without considering the benefits of exposure to risk which playgrounds provide.

Recommendation 3: *The use of the word 'safe' in the context of playgrounds is potentially misleading and its use in such circumstances might best be avoided. Play bodies might also consider whether designating playgrounds as areas of risk(rather than as safe areas), could be beneficial overall. for instance, a simple grading system could be devised which scored playgrounds according to the degree of challenge present.*¹⁶⁰

8.4 STANDARDS

The position established by the new European Standard is interesting. For instance, on the one hand, equipment height as a risk factor has not been taken as seriously as some epidemiologists have recommended based on reasonable scientific evidence, though without apparent consideration of play value. On the other hand, the provision of impact absorbing surfaces has been taken very seriously despite the evidence being relatively meagre. Furthermore, in the UK context, the ALARP criterion seems unlikely to be satisfied by surfacing when considered at the strategic level. This suggests that the interests of children are better served by investing these resources in other ways. In the UK a good number of playgrounds are also located on grass or grass/earth. Grass grows well in the British climate and arguably has other properties which recommend it for play, such as naturalness which is a valued commodity in many circumstances.¹²⁴

¹⁶⁰ A number of sports already grade their challenges, for example, rock climbing, orienteering and skiing, so there is nothing inherently new in this.

One particular problem associated with Standards is their highly literal interpretation in some courts, effectively acting as fuel for litigation.¹⁶¹ In reality, the linkage between some of the recommendations in Standards, and the way they are interpreted, and risk to children, is actually tenuous. Most Standards offer sound advice, but over-attention to minutely-detailed measurements can in some circumstances be misleading and inappropriate.

A general problem with prescribed safety criteria is that they encourage a less thoughtful approach to risk management. If a duty holder believes that by following a certain specification to the letter, safety will have been achieved, then s/he is less likely to engage in goal seeking initiatives to manage risk. In fact, a key underlying intent of the Health & Safety at Work Act 1974 was to bring about a more thoughtful and hence successful approach to the management of risks by establishing a general principle (ALARP) rather than by imposing numerous requirements of a specific nature.

Recommendation 4: *The strengths and limitations of Standards need to be more fully appreciated. Standards should not be used as a means of warding off litigation, nor as an excuse for not thinking more widely about the needs of children. While their contents must be carefully noted, they should also be interpreted and applied with intelligence. Standards should not be seen as synonymous with or as an alternative to a properly conducted risk assessment and requisite knowledge of on-going research.*

8.5 GOOD PRACTICE

The answer as to what constitutes good practice varies from stakeholder to stakeholder. The position discussed here is primarily that applying to play providers, mainly local government and educational agencies. Factors which need to be taken into account in decision making by these agencies include community needs, as expressed by the more and the less vocal sectors, legal requirements (as, for example, in the HSWA 1974), and accountability for public expenditure. Because these agencies are in many cases large, or large if acting in groups, the potential for strategic risk management decision making is clearly apparent.

Strategic risk management requires a pro-active approach, an awareness of research and information, and the ability to apply it to decision making. In short, all are well-established requirements of modern day risk managers and no agency with any hint of strategic responsibilities should these days be without these skills. The first step in strategic risk management is risk assessment (Figure 1). Having conducted a risk assessment,^{162, 163} information is then available to assist the decision making process. In the case of safety-driven decisions, these would no doubt consider the outcome of the risk assessment, the practicability of control measures, any knock on effects of risk control measures (e.g. risk transfers, effects on the activity and its goals such as play value, etc.), the needs of the community, published advice, and so on.

¹⁶¹ T. B. Hendy, 'The role of the playground safety audit in developing a comprehensive playground safety programme,' Proceedings of 'Playground Safety,' Penn State, 1999, edited by M. L. Christiansen. ISBN 0 960342 1 6.

¹⁶² Experience has shown that some people carrying out risk assessments of UK playgrounds are doing no more than comparing the dimensions of play equipment with specifications in published documents e.g. BS 5696. Although some aspects of this are helpful, searching for head traps etc., this is not considered here to be a risk assessment, which is taken as a quantitative assessment of the likelihood of harm.

¹⁶³ See also Appendix 6 of 'Successful health and safety management,' HSE Books, 1997. ISBN 0 7176 1276 7.

The clear advantage of this approach is that it enables a fuller perspective to be gained of, in this case, risk, so that priority areas can be identified in terms of the local or regional needs of children rather than being driven by special interests arising, perhaps, from only remotely connected actors. Risk assessments should, of course, be documented, and this takes time, but the importance of documentation is that it demonstrates that risks have been considered, it shows the basis of decisions made, and in time it should indicate how decisions have been implemented, monitored and adjusted as necessary in the light of experience. Although not the primary reason for doing it, such documentation can be invaluable in legal cases. In many situations where reasonable risk management decisions have in fact been made, the failure to produce documentary evidence leads to prosecution. It is suggested that were such documentation produced more systematically, certainly in the context of this example of playground safety, the prospect of speculative litigation might soon be reduced, to everyone's advantage. There would also be the prospect of interaction and feedback from interested parties were these documents publicly available, reducing the likelihood of exclusion of important but not necessarily vocal communities.

From the point of view of the Regulator, it is recommended that further encouragement be given by them to duty holders to conduct strategic risk assessments of play provision taking account of the risks of provision, the benefits of provision, and the risks and losses associated with non-provision or unplanned provision. National play advisory groups might also consider this issue and determine to what extent an agreed position can be reached. Such bodies and their pronouncements have, of course, a major influence on policy, not to mention court rulings.

Recommendation 5: *Good practice requires the conduct of risk assessment at the local, jurisdictional, or strategic level. This should take account of the overall distribution of risk experienced by children within the relevant jurisdiction, the practicability of control measures (as defined by the HSWA 1974), the benefits of the activity (play) and any effects on that of control measures, and the scope for improving the benefit to risk ratio. Decisions made, the underlying basis of them, implementation, monitoring procedures, and any strategy revision, need to be written down and would also benefit from being made publicly available.*

8.6 PLAYGROUND SURFACING

Faced with the substantial uncertainties over the risk-benefit balance offered by alternative surfacing, as summarised in Table C1 and described in Appendix C, any strategic level decision on this topic would be more a matter of belief than of scientifically derived certitude. In view of this, it may be considered appropriate that such decisions should be delegated to individual authorities who may, for instance, have the option of making public investments which are more guaranteed to produce tangible gains. For example, providing a skate park for children may be more effective in providing play opportunities and reducing injuries overall than replacing grassy playgrounds with a compliant surfaces. This, in view of many historical commitments to the desirability of surfacing, is perhaps a difficult proposition to which to adjust. However, in the interests of sound decision making and, ultimately, children's welfare, not forgetting the tax payer's money, it is one which suggests itself for re-examination by the appropriate agencies.

Recommendation 6: *That agencies concerned with play and play provision review policies on playground surfacing in the light current evidence.*

8.7 RESEARCH NEEDS

The evidence accumulated in this report indicates that the most pressing research needs associated with children's play are not now in fact related to risk factors on the playground, a substantial amount of useful work having been done which, while not entirely definitive, at least permits things to be put in perspective. Issues appearing more important, in some cases through lack of research, are as follows:

- if play is accepted as a fundamental right of children and is as important as most people appear to believe, then it is absolutely necessary to obtain some measure of where children play, for how long, in what numbers, and how this depends on age (concern over provision for young teenagers has been highlighted,³ but other age groups will have equivalent needs). An appropriate survey could be designed for this purpose which, it is suggested, might be repeated at, say, five to ten year intervals in order to investigate trends in play patterns. It may be considered that such a survey should also include other pursuits, like sports, or even all activities, as was done in the USA,⁴³ although this risks diluting the amount of information on play itself. Though this suggestion is made primarily through concern about what might be lost or missing in the way of play opportunities, it may be that it could also serve as a means of measuring childhood exposure, at least at the strategic level, to different environments. As noted earlier, exposure assessment is a key component of risk assessment, but one that is frequently neglected.⁵⁴ Such information could be used to inform local planning, although would not replace the kind of detailed study of needs recently conducted by, for example, Leicester City Council.¹⁶⁴
- again, if play is accepted as being as important as is commonly said, then more research would appear warranted on the different kinds of play opportunities which can be provided and the benefits for different age groups. At present the danger is that safety concerns, real or perceived, and litigation, have a bigger hand in determining the types of play facilities made available than does any consideration of play benefits. Increasingly, the opinions of children themselves are seen as important.¹⁰³
- in the present environment, playground injuries are most commonly investigated in the context of supposed failures of provision, where failure is assessed in terms of lack of compliance with some written advice, standard, or other document. As pointed out by Hurst, accidents are functions of not just hardware but also systems and cultures, and people.¹⁶⁵ It is suggested that further research is necessary into psychosocial and developmental influences on injuries and injury-associated behaviours.¹¹⁵
- given that court decisions are placing pressure on play providers, it is also suggested that research be conducted into decision making processes in these settings. There are worrying signs that issues important from the perspective of providers are getting short shrift in some courts. For example, play providers are of course subject to the HSWA 1974 implying a requirement to reduce risks so far as reasonably practicable, but courts at times seem either unaware of or unwilling to heed this doctrine and its implications. Further, as noted by Rimington,¹³⁵ many cases are decided from a retrospective basis

¹⁶⁴ Personal communication, Adrian Edge, Leicester City Council.

¹⁶⁵ N. W. Hurst, 'Risk assessment – the human dimension,' Royal Society of Chemistry, 1998. ISBN 0 85404 554 6.

(knowing where an accident occurred and what happened etc.), whereas most play providers have to make strategic decisions about resource allocation from an ex ante position. What is eminently sensible from one position may not appear so from the other. Other problems include lack of familiarity with what is scientifically known and what is based on beliefs, failure to consider the benefits of an activity as well as the risks, and lack of awareness of risk transfer mechanisms. Of course, it may turn out that some of these apparent deficiencies are attributable to the kind of expert advice given to courts, in which case remedies would need to be taken within that profession.

APPENDIX A

ANALYSIS OF THE 1998 DTI LASS DATA SET

A1.1 PUBLIC PLAYGROUNDS

According to the Table LASS 2 on page 34 of the 1988 annual report of DTI CSU, 1,652 public playground accident cases were recorded at the 18 hospitals taking part in the scheme during that year. By extrapolation (the 1998 LASS scale factor is 19.53), the national estimate of public playground cases is reported as 32,264 with a stated 95% confidence interval of 31,914 to 32,618.

For this research it was planned that the descriptions of the 1,652 accidents would be examined primarily in order to find out more about causal mechanisms. However, while doing this it became apparent that a significant number of the 1,652 accidents assigned to the public playground category had not apparently occurred in public playgrounds, and furthermore that many others were not associated with activities that could reasonably be construed as playground-related. At this point it became important to check through the data before conducting further analysis. Although this was a lengthy task, it was judged necessary in order to gain confidence in the data set and any conclusions drawn from it. It is acknowledged that checking through the data set entailed frequent value judgements. It was not always crystal clear, from the information given, how an accident should be classified. However, at least the nature of these judgements is known rather than subsumed into the database.

This process indicated that approximately 117, and perhaps a good many more, of the 1,652 cases had not occurred in public playgrounds, specific mention having been made of other venues such as indoor centres, bouncy castles, parks in general, skate bowls, scout camps, tennis courts, astro-turf pitches, cycle tracks, school playgrounds, soft play centres, waste ground, assault courses, goal posts, BMX tracks, play barns and other venues.¹⁶⁶

A further 200 approximately of the 1,652 cases, while potentially occurring in playgrounds, did not involve equipment or items associated with playgrounds and although they may have occurred on playgrounds are discounted for the purpose of this investigation. The kinds of items which were mentioned in this group were many and varied: goal post, mountain bike, syringe, wasp, shoe, golf club, plastic tray, metal gate (25 cases), baby buggy, motor bike, football, various thrown objects, roller blades, snooker ball, insect bite, toy gun, park bench, skateboard, cricket ball, tree, basketball, boomerang, coat zip, traffic cone, go-kart, telegraph post, hurdle, volley ball, firework, catapult, cricket ball, tennis racket, golf ball, settee, table tennis table, air gun pellet, and yo yo.

Another group of accidents, amounting to a further 240 of the 1,652 cases, appeared also to have little to do with public playgrounds *per se* and may also not have occurred on them. These cases involved things like playing football or some other sport, cycle-related accidents, falling out of a

¹⁶⁶ This figure of 117 could represent a significant underestimate of the true number of non-public playground accidents included in the 1,652 cases. For example, there were numerous cases in which reference was made to parkland and games such as football (140 of the 1,652 cases referred to football), to cycling or cycles (43 cases) and to other sports (75 cases). It is probable that many of these cases did not occur in public playgrounds as such, but in general parkland areas.

tree, falling from a wall, fighting, being trodden on, being pushed, running into a picnic table, being bitten by a dog, and suffering an internal injury due to unfitness or an awkward movement.

It would appear from this that the estimated number of cases assignable to public playgrounds and activities related to what would reasonably be understood as conventional play in these areas, on or off the fixed equipment, should be revised downwards to about 1,059.¹⁶⁷ Furthermore, the database contains cases involving adults up to 75 years of age. The decision has been taken to screen out all cases where the injured person is above 16 years of age.¹⁶⁸ The resulting database contains 1,000 cases. This suggests that the national estimate of public playground accidents for children up to 16 years of age resulting in A & E attendances in 1998 could be in the region of 20,000, depending upon one's definitional preferences.¹⁶⁹

To go further, of the 1,000 cases, 854 mentioned a piece of playground equipment (this is not meant to imply causality) and the remaining 146 did not, but were still considered to have occurred on a public playground and involved a genuine play activity. Scrutiny of the 146 cases indicates that approximately 60 % were due to trips or falls on the same level, 20 % were attributable to collisions with other persons or objects, and the remaining 20 % to a miscellany of causes.¹⁷⁰

Of the 854 cases mentioning equipment, 172 (21%) identified slides, 60 (7 %) seesaws, 229 (27 %) swings, 256 (31 %) climbing frames, 16 (2 %) firemen's poles, 46 (5 %) roundabouts, 46 (5 %) other equipment, and 29 (3 %) did not identify specific equipment.

A1.1.1 Slide Cases

The 172 case descriptions were examined. Of these, 46 made reference to an identifiable behavioural element such as running into a slide, being pushed off, climbing the chute, being struck by another person, walking down the chute, jumping off, using the equipment at night, wearing roller blades, head first or backwards descents, playing tig, and so on.¹⁷¹ Of the remaining 126, 70 referred to falls from a height, either from the chute or the steps, 35 mentioned knocking against the equipment, and the remaining 15 a variety of factors including splinters, exercise-induced strain, plus a few cases with no details. Six cases were screened out as not relevant.

¹⁶⁷ An additional few cases (25) were too thinly described to be assigned confidently and have been subtracted from the total, as have eleven cases reported as occurring on 'adventure playgrounds' because the issues involved with adventure play are discrete.

¹⁶⁸ It is recognised that this is an arbitrary cut off and that although there are cases involving older children and even adults, these are greatly outnumbered by the 0 to 16 years age group. Furthermore, the issues raised are not necessarily the same for younger children.

¹⁶⁹ For instance, one might define playground accidents as any accident occurring on a playground, or as just those involving play equipment, or one might use a different criterion than the LASS one of A & E attendance.

¹⁷⁰ These include being pushed over by another child, being hit by a thrown object, getting sand or woodchips in the eyes, playing in bare feet and injuring toes, or simply a foot 'giving way' while running about.

¹⁷¹ It is acknowledged that some of these activities, such as walking up a slide chute, could be regarded as legitimate play or not, depending on one's point of view.

Of the 172 cases, 44 mentioned fractures and 2 concussion. Other cases largely comprised cuts, bruises, abrasions, tenderness and swelling. The fracture cases were distributed as follows: fingers (3); arm (11); shoulder (2); wrist (13); elbow (9); lower limb (3); and foot (3). Nine of the 172 cases were detained as in-patients with a mean stay of 1.8 days.

The database contains no measure of injury severity and this can only be crudely inferred from indicators such as number of in-patient days, if any, or the type of injury e.g. a fracture is often taken as a potentially more serious injury than, say, bruising. A tabulation of fall-related injuries involving either a fracture or no fracture against the type of surface under the equipment is provided in the following Table A1.

Surface	Concrete	Tarmac	Sand	Bark/chip	Grass/earth	Rubber	Other	Unknown	Total
Fracture	2	2	-	3	2	1	-	15	25
No fracture	7	2	-	4	1	8	4	11	37
Unknown	1	-	-	-	-	-	-	2	3
Total	10	4	-	7	3	9	4	28	65

Table A1: Numbers of cases with or without fractures versus surface beneath slides for cases reported as involving falls to the surface from a slide.

A1.1.2 Climbing Frame Cases

Of the 256 cases described, 27 had an identifiable behavioural element such as playing ‘tig,’ jumping off, nighttime use, playing hide and seek, running into the frame, standing on monkey bars, biting one’s tongue, wearing clogs, wearing platform shoes, and having a bike on the frame. Of the remaining 229, the majority is reported as falls of one kind or another. 192 cases involved falls from a height to ground, of which 54 mentioned monkey bars specifically (it is suspected that this term is also used by some people to describe climbing frames). Thirteen cases mentioned striking the equipment during falling, and 6 referred to falling against the equipment. There were 6 reported cases of banging oneself on equipment, 5 of strain injuries, and a small number of other cases or cases with few details.

Of the 256 cases, 99 mentioned fractures and 9 concussion. Other cases largely comprised cuts, bruises, sprains and tenderness. The fracture cases were distributed as follows: hand (1); arm (36); shoulder (0); wrist (36); elbow (18); lower limb (3); foot (4) and nose (1).

Thirty three of the 256 cases were detained as in-patients with a mean stay of 2.7 days. One of these cases involved an allegedly autistic child who accounted for 28 in-patient days alone. Without this case the mean stay is 1.9 days.

A tabulation of injuries involving a fracture or no fracture against the type of surface under the equipment is provided in the following Table A2.

Surface	Concrete	Tarmac	Sand	Bark/chip	Grass/earth	Rubber	Other	Unknown	Total
Fracture	2	1	4	23	4	17	2	33	86
No fracture	15	9	2	16	7	13	5	35	102
Unknown	-	-	-	-	-	1	-	1	2
Total	17	10	6	39	11	31	7	69	190

Table A2: Numbers of cases with or without fractures versus surface beneath climbing frames for cases reported as involving falls to the surface.

A1.1.3 Swing Cases

Of the 229 cases described, 95 could be classified as having a behavioural element. These are made up of 39 cases of being hit by a swing, 25 of jumping off, and 31 other types of event. Whether or not the 39 cases of being struck is defined as behavioural or not is a matter of opinion. Of the remaining 134 cases, the majority, 106, are reported as falls to the ground but some others, 6 cases, refer to falls while mounting or dismounting and it may be that a proportion of the 106 more correctly belong in this category. Four cases mentioned striking or colliding with an object or person, 3 referred to being caught or pinched, and there were small numbers of cases which referred to strain injuries or other events, or which were not relevant in some way.

Of the 229 cases, 60 mentioned fractures and 3 concussion. The fracture cases were distributed as follows: jaw (1); hand (1); fingers (2); arm (17); shoulder (3); wrist (27); elbow (8); lower limb (-); foot (-) and nose (1).

Seventeen of the 229 cases were detained as in-patients with a mean stay of 1.6 days.

Table A3 shows the distribution of cases between those involving fractures and those not involving fractures for different surfaces fallen onto.

Surface	Concrete	Tarmac	Sand	Bark/chip	Grass/earth	Rubber	Other	Unknown	Total
Fracture	3	5	-	7	6	8	-	18	47
No fracture	3	5	-	12	15	6	2	27	70
Unknown	-	-	-	-	-	1	-	1	2
Total	6	10	-	19	21	15	2	46	119

Table A3: analysis of falls (and some jumps) from swings and consequence versus surface type.

A1.1.4 Rocking Horse Cases

Of the 60 rocking horse/seesaw cases, 15 identified a behavioural element including the following types: being tipped or pushed off; jumping off; balance upset by behaviour of other users. Of the remaining 45 cases, 10 involved falling off to the ground, 5 falling and striking the equipment, 20 hitting oneself on the equipment, and 7 getting crushed or pinched. There were two apparent strain injuries and one case was not relevant.

Of the 60 cases, nine involved fractures and none concussion. The fractures related to the following body parts: fingers (1); shoulder (3); wrist (3); elbow (1); lower limb (-); and foot (1).

Three of the 60 cases were detained as in-patients with a mean stay of 3.3 days. One case was in for 7 days. Excluding this case, the mean number of in-patient days per in-patient is 1.5.

A1.1.5 Roundabout Cases

Of the 46 cases involving roundabouts, 16 had an identifiable behavioural element, for example, being tripped or pushed, jumping on or off, and behaviour of other children in pushing it too fast.

The remaining 30 cases involved 16 described as falls from the equipment, 6 of being struck, and 6 where a body part was caught, one case of dizziness and one with insufficient information.

Of the 46 cases 9 mentioned fractures and none concussion. The fracture cases were distributed as follows: collar bone (1); hand (-); arm (3); shoulder (1); wrist (-); elbow (-); lower limb (2); foot (2) and nose (-).

A1.1.6 Summary of Public Playground Cases

Table A4 summarises some of the above data for public playgrounds. The Table deals with those cases naming one of the five most commonly encountered equipment types, and not those other accidents happening in the play area which are unrelated to equipment.

Equipment type	Total cases	Behavioural factors ¹⁷²	Fall from a height	Hit equipment or other object	Other cause	Unknown	Cases not relevant	Total of relevant cases
Slides	172	46 (28%)	70 (42)	35 (21)	9 (5)	6 (4)	6	166 (100)
Climbing frames	256	27 (11)	190 (75)	25 (10)	8 (3)	2 (1)	4	252 (100)
Swings	229	95 ^a (43)	106 (48)	4 (2)	14 (6)	-	10	219 (100)
Seesaws	60	15 (25)	10 (17)	25 (42)	9 (15)	-	1	59 (100)
Roundabouts	46	16 (35)	16 (35)	6 (13)	7 (15)	1 (2)	-	46 (100)

Table A4: Summary of factors contributing to equipment related cases for the five most common types of equipment.

^aIncludes 39 cases of being hit by a swing, 25 of jumping on or off, and 31 others. The 39 cases could also have been entered under the column headed 'hit equipment or other object.'

Table A5 brings together the fall consequence data (fracture or no fracture) for swings, climbing frames and slides.

Surface	Concrete	Tarmac	Sand	Bark/chip	Grass/earth	Rubber	Other	Unknown	Total
Fracture	7	8	4	33	12	26	2	66	158
No fracture	25	16	2	32	23	27	11	73	209
Unknown	1	-	-	-	-	2	-	4	7
Total	33	24	6	65	35	55	13	143	374

Table A5: analysis of fall consequences for swings, climbing frames and slides combined versus surface type.

A1.2 SCHOOL PLAYGROUNDS

According to Table LASS 2 on page 34 of the 1988 annual report, 7,589 school playground accident cases were recorded at the 18 hospitals taking part in the scheme during that year. On

¹⁷² What is considered as reasonable behaviour depends on one's point of view. For those with a liberal interpretation of equipment use it may be preferred that some, even most, of these cases be assigned to the other columns.

the basis of this, the national estimate of school playground cases is reported as 148,213 with a confidence interval of 147,460 to 148,969.

For this research every seventh record of the 7,589 cases has been examined (1,085 records) to evaluate the data and to find out more about causal mechanisms. The summary Table A6 shows the results of this analysis. Thirty three percent of cases were attributable to slips and falls in the playground, either on level ground or steps in the vicinity of the playground, but which were unrelated to equipment, 15 per cent involved collisions with objects or other persons, 17 per cent involved behavioural elements such as pushing, tripping or boisterous play some of which was deliberate and some unintended. A further 23 per cent involved the playing of sports, especially football, and just 3.3 % involved playground equipment.

From this it may be estimated that in the region of 4,800 playground-equipment related accidents occurred in school playgrounds in 1998.

Activity or event at time of accident	Number of cases	Percentage
Slip or trip ^a	353	33
Collision with person or object	164	15
Behavioural factors ^b	176	17
Sports activity ^c	249	23
Playground-equipment related ^d	35	3.3
Other ^e	80	7.4
Unknown	12	1.1
Total ^f	1,069	100

Table A6: Results of the analysis of the 1,069 cases registered against school playgrounds in terms of the activity or nature of the incident at the time of the accident.

^aIncluding cases where 'tag' was being played

^bIncluding being pushed over, tripped or trodden on through intentional or unintentional actions

^cNumerous cases involved sports such as football, netball, hockey, cricket and rugby, football being by far the most frequent activity at the time of occurrence of these cases

^dAll of these cases mentioned play equipment although this does not imply causality

^eThese cases are exceedingly varied: e.g. bitten by insect or dog; pushed object into nose; climbing walls; muscle strain; falling from a cycle; cut on broken glass; swallowing object; dropping heavy object on feet; throwing of stones and sand; windblown dust in the eye; skateboards; catching a foot in a satchel strap and falling; shutting fingers in a school gate; falling from a shopping trolley

^fThe total omits sixteen of the 1,085 cases which appear to have been misassigned to the school playground category

A1.3 OTHER LOCATIONS

It is to be expected that besides public and school playgrounds other locations referred to in Table LASS 2 on page 34 of the 1988 annual report will have playground equipment which will have contributed to accident totals. For this reason the LASS data base has been interrogated for 1988 and a Table produced of accident cases which identified the most common types of play equipment versus location. Six equipment types were searched for on the data base: climbing frames, slides, seesaws, roundabouts, rope swings and swings. The following Table A7 gives the number of cases, and a national estimate, by the most important types of location in terms of accidents involving these pieces of equipment. By definition, this Table cannot include any accidents occurring on playgrounds unless they involve or name equipment.

Location	Climbing frame	Slide	Seesaw	Round -about	Rope swing	Swing	Sum	National estimate
School	180	42	6	4	1	10	243	4746
Public playground	252	186	54	51	12	232	787	15370
Creche/nursery	15	12	2	0	0	0	29	566
Public house or social club	43	47	1	0	1	11	103	2012
Other leisure facility	22	70	0	3	3	2	100	1953
Parkland	150	92	40	23	28	146	479	9355
Countryside	1	0	1	0	66	3	71	1387
Other location	112	116	9	4	61	36	338	6600
Unknown location	163	126	27	13	67	198	594	11601
Total	938	691	140	98	239	638	2744	53590
National estimate	18319	13495	2734	1914	4668	12460	53590	

Table A7: Numbers of cases associated with the main equipment types for all LASS locations.

So far, of the categories in this Table, school playgrounds and public playgrounds have been examined. The remaining categories (with the exception of creche/nursery because these are mainly indoor activities) are now considered at the case level. This has been done by extracting individual case descriptions from the LASS data base for each of these locations.

A1.4 PUBLIC HOUSES

Data were obtained on 102 cases. Of these, 37 occurred in indoor play venues, 42 occurred outside, and for 23 the location was unclear. Although not the focus of this report, a few observations can be made on the indoor cases. Of the 37, 15 referred to incidents in ball pools, mainly when used as landing zones for slides. It is noted that some of the children involved were very young eg one year. Collisions with equipment and other children appeared comparatively frequent although the data are fairly few. However, given the nature of some indoor play facilities and the problems of supervising enclosed areas this is probably not surprising.

Most cases referred to slides (47), climbing frames (38) and swings (11). Of these, the slide and climbing frame cases perhaps warrant a little further comment. Six of the slide case descriptions identified a behavioural element. Of the remaining 41 cases, 10 involved a fall from a height, 14 being knocked or caught, 14 being hurt while exiting, and there were 3 cases of self injury. Eight of the 47 cases resulted in a fracture.

For the climbing frame cases, four were judged to have a behavioural element, 25 involved a fall from a height, 8 striking the equipment, and there was one case of a strain injury.

Of the 18 fractures, 8 involved the wrist and 6 the arm.

A1.5 OTHER LEISURE LOCATIONS

Data were obtained on 100 cases. The majority related to indoor soft play or adventure play and just 28 appeared relevant to outdoor play of the kind of primary interest here. Given the small number of cases further analysis has not been conducted.

A1.6 PARKLAND

477 cases were examined. Fifteen cases only were screened out, due to apparent misallocation of location or lack of relevance to play. A further 27 cases involving rope swings were also taken out as these appeared from the descriptions to be DIY equipment items. This left 435 cases of which slides were mentioned in 87, seesaws in 41, swings in 139, climbing frames in 144, firemans' poles in 3, roundabouts in 20, with 2 other items.

Of the 87 slide cases, 30 were judged as having a behavioral element.¹⁷³ The remaining 57 cases included 28 falls from a height, 19 knocks against the equipment, 3 cases of strain injury, and 7 others (eg cuts on glass, splinters etc.). There were 18 cases of fracture and two of concussion. Fractures were mainly of the various parts of the upper limb.

Surface	Concrete	Tarmac	Sand	Bark/chip	Grass/earth	Rubber	Other IAS	Unknown	Total
Fracture	1	-	-	2	-	-	2	2	7
No fracture	3	4	1	3	1	1	-	7	20
Unknown	-	-	-	-	-	-	-	-	-
Total	4	4	1	5	1	1	2	9	27

Table A8: Analysis of fall consequences for slides in parkland areas versus surface type.

Of the 41 cases involving seesaws, 8 were judged as having a behavioural component. Almost universally the behavioral factors involved the actions of the person at the other end of the seesaw. Of the remaining 33 cases, 16 involved falls from the apparatus, 11 concerned striking oneself against the object, 4 involved crushing or pinching, and there were two other miscellaneous cases. Three fractures were recorded but there were no in-patient stays and no cases of concussion.

Of the 139 swing cases, 55 involved a behavioural element such as being struck by a swing (24 cases), jumping off (15 cases), and miscellaneous factors such as wearing roller blades, landing on broken glass, and being intoxicated. The remaining 84 cases mainly were ascribed to falls (72 cases). In all, 35 fractures were reported and none of concussion. The fracture cases were distributed as follows: lower arm (5); upper arm (1); shoulder (3); wrist (17); elbow (3); finger (1); lower limb (2); foot (1); ankle (2).

Overall, the number of in-patients associated with these cases was 7 for a total of 12 days, implying 1.7 inpatient-days per in-patient.

Surface	Concrete	Tarmac	Gravel	Bark/chip	Grass/earth	Rubber	Other IAS	Unknown	Total
Fracture	3	1	1	4	5	5	2	6	27
No fracture	13	7	1	11	3	1	4	16	56
Unknown	-	-	-	-	-	-	-	1	1
Total	16	8	2	15	8	6	6	23	84

Table A9: Analysis of fall consequences for swings in parkland areas versus surface type.

¹⁷³ For example, being pushed, wearing roller skates, riding a skate board, climbing up or running down or running into a slide.

Of the 144 climbing frame cases, 12 were judged as having behavioural elements. Of the remaining 132 cases, 91 involved falls to the ground, 35 falling onto or striking the equipment, with a handful of miscellaneous cases. There were 51 fractures reported overall: arm (9); shoulder (4); wrist (22); elbow (9); finger (1); hand (1); lower limb (4); ankle (1), and 3 cases of concussion. Total in-patients was 7 for 15 in-patient days, which averages out at 2.1 inpatient-days per in-patient.¹⁷⁴

Surface	Concrete	Tarmac	Sand	Bark/chip	Grass/earth	Rubber	Other IAS	Unknown	Total
Fracture	-	-	1	18	3	6	5	15	48
No fracture	6	-	-	16	3	9	2	12	48
Unknown	-	-	-	-	-	-	-	-	-
Total	6	-	1	34	6	15	7	27	96

Table A10: Analysis of fall consequences for climbing frames in parkland areas versus surface type.

Of the 20 cases mentioning roundabouts, 7 were judged as having a behavioral element. The remaining 13 involved falls in 9 cases and being caught in the remainder. There were two fracture cases: wrist (1) and shoulder (1). No cases of concussion or of in-patient stays were reported for this group.

A1.7 COUNTRYSIDE AND WOODLAND

Of the 71 cases considered, the vast majority (64) concerned rope swings which, so far as could be inferred from the case descriptions, were largely home-made and hence outside the normal remit of this investigation. Three other cases were also adjudged as not relevant to the study, leaving just 4 cases of which two appeared to involve conventional swings, and the others a seesaw and a climbing frame. Doubtless because of the provenance of the rope swings, there was an unusual number of cases (10) mentioning equipment defects including broken branches, seats and ropes.

Most of the rope swing cases identify falls to the ground as being a factor (55), with 7 cases involving striking or being struck. There were 20 fracture cases, and 8 in-patients with a mean stay of 1.1 days.

Surface	Stone or stones	Earth/mud	Grass	Other object ^a	Unknown	Total
Fracture	2	8	6	2	2	20
No fracture	5	13	9	3	3	33
Unknown	-	1	-	-	-	1
Total	7	22	15	5	5	54

Table A11: Analysis of fall consequences for rope swings in countryside and woodland areas versus surface type.

^aFor example, a tree stump.

¹⁷⁴ This excludes, on the basis of age, one 32 year-old who fell 0.8 metres onto tarmac and spent 24 days in hospital with a fractured leg.

A1.8 OTHER LOCATIONS

Examination of 112 cases in this category showed them to relate to unidentified 'public places' (62 cases); indoor play (17); self-organised play (13); assault courses (3); inflatable objects (2); adventure play (8); public houses (4); and waste ground (2). Three cases were eliminated on the basis of the age of the patient. All of the cases occurring in 'public places' mentioned a piece of equipment and were taken as relevant to the study. Even so, the number of cases is rather small and was not considered fruitful for further analysis.

A1.9 UNKNOWN LOCATIONS

Most data bases have large entries in the 'unknown/unclassified' category and the LASS data base is no exception. Indeed, Table A7 shows the unknown category to be second only to public playgrounds in terms of numbers of cases. A sample of 592 cases in this category have been assessed, from which it has been concluded that 25 involve persons older than 16 years. The case descriptions indicate that about 80 per cent of the remaining cases should be included in the overall tally of equipment-related cases.

A1.10 SUMMARY OF ACCIDENT LOCATION DATA

The following Table A12 combines some of the data on the numbers of cases in the different locations. This has been done in a slightly different way from the preceding sections in order to facilitate comparisons between the various locations. Starting with the most important group, public playgrounds, it will be recalled that the initial number of LASS cases was 1,652. After screening, by which is meant the removal of those cases thought to have occurred elsewhere, those affecting persons older than 16 years, and a few cases with too little data, 1,440 cases are left. Of these, about 586 did not involve play equipment as such and 854 did. From this, the national estimate of cases occurring on playgrounds but unrelated to equipment is 11,400. However, most of these cases are felt to have little to do with the playground itself and it can be argued could have occurred anywhere. Probably most important are those which somehow relate to playground equipment, for which the national estimate is 16,700 cases.

The next most important group in terms of numbers of cases examined is school playgrounds. Using the same system the national estimate of cases with some relationship to playground equipment is 4,800. The remaining locations have been dealt with in similar fashion, with the results shown in Table A12.

A1.11 AGE DISTRIBUTION OF CASES

Table A.13 gives data on childhood victims of play-related A & E attendances by age group for each year from 1988 to 1999. One reason for assembling this Table was to enable a search for any evidence of temporal change in the ages of children being injured on play equipment, which might in turn indicate a trend in the age ranges using playgrounds. In fact, if the percentage of cases assignable to the 10 to 14 year age group is taken as such a measure, this can be seen to have been remarkably steady throughout the 12 year period.

LASS location	No. of cases examined	No. after screening	No. not involving equipment	No. naming equipment	Scale factor	National estimate ^{d,k}
Public playground	1,652	1,440 ^a	586 ^b	854 ^c	19.53	16,700
School playground	1,085	1,069 ^e	1,034 ^f	35	7x19.53	4,800
Public house etc.	102	55 ^g	0	102	19.53	1,100
Other leisure facility	100	28	0	28	19.53	500 ^h
Parkland	477	435 ⁱ	0	435	19.53	8,500
Country and woodland	71	4 ^j	0	4	19.53	100
Other locations	112	62	0	62	19.53	1,200
Unknown location	592	450	0	450	19.53	8,900
Total						41,800

Table A12: Summary of playground cases in resulting in A & E attendance in 1998 by location. The figures in the right hand column do not include accidents occurring on playgrounds unless a piece of equipment (slide, swing, climbing frame, seesaw or roundabout) has been named.

^aCases were screened out where other locations were mentioned, where victims were above 16 years of age, and where case descriptions were inadequate to make judgements.

^{b,c}The cases after screening are split into those naming equipment and those not naming equipment. The latter include 200 cases involved non play equipment items presumably brought onto the playground or arriving there by some other means, 240 cases with no particular connection with playgrounds such as playing football or some other sport, and 146 cases of playground activity resulting in an accident but which did not entail equipment.

^dEquipment-related cases only.

^eScreening primarily on a locational basis.

^fMost school playground accidents involve slips and trips, collisions, behavioural factors and informal sports.

^gOne third to one half of the public house cases probably occurred on indoor play facilities.

^hIndoor and adventure play are not included.

ⁱOf the 477 cases examined, 15 were screened out because they appeared to have occurred elsewhere (eg in someone's garden) or involved causes irrelevant to play. A further 27 cases involving rope swings were also taken out as these appeared to be DIY facilities.

^jMost cases involve home-made rope swings and have been screened out.

^kAll numbers in this column are rounded to the nearest 100.

Age/Year	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
0-4	256	324	289	351	244	116	120	188	331	285	306	404
5-9	537	594	653	640	495	288	282	360	676	651	625	870
10-14	387	389	481	437	331	175	208	262	516	468	518	623
15-16	54	68	53	54	42	15	20	34	62	57	78	78
Total 0-16	1,234	1,375	1,476	1,482	1,112	594	630	844	1,585	1,461	1,527	1,975
10-14 as a % of total	31	28	33	29	30	29	33	31	33	32	34	32

Table A13: Age distribution of childhood A & E attendances following accidents on public playgrounds.

APPENDIX B

FURTHER ANALYSIS OF TRENDS

As a starting point, Figure 3 is repeated here showing that the overall number of playground-derived A & E cases has remained essentially constant since the late '80s. Given that playground provision and usage are believed to have changed significantly during this period, and that a number of safety interventions have been gradually phased in, it would be expected that some trends would be apparent, at the micro if not at the macro level. Indeed, a close examination of Figure 3 (and Table 4) indicates that perhaps the number of cases associated with climbing frames has increased, while that associated with swings has declined, and that with slides is relatively constant.

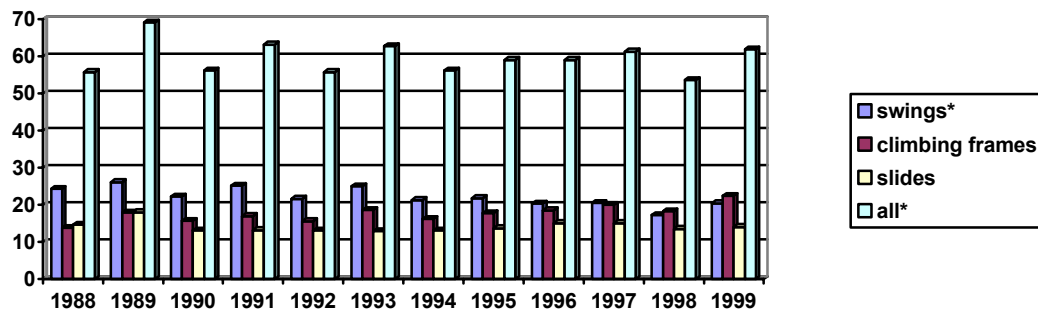


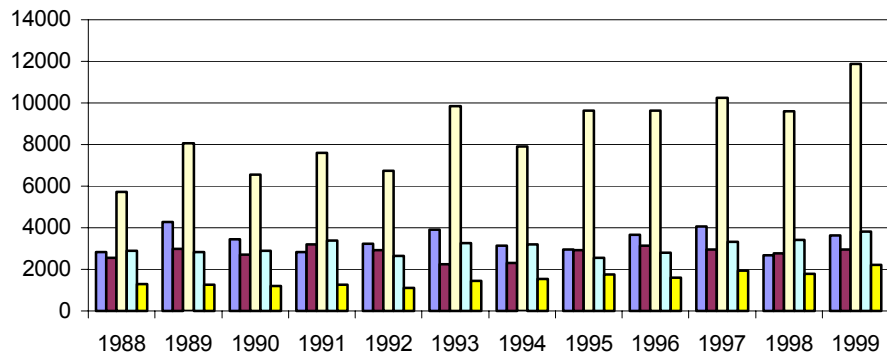
Figure 3: Trends in LASS-reported A & E cases (thousands) for selected items of equipment. Note: no allowance for usage or availability is made in this summary. * 'swings' include rope swings; 'all' includes roundabouts etc.

Figures B1 and B2 offer some further insight, showing the numbers of cases broken down by major body part(s) affected. In the case of climbing frames, it appears that the apparent increase is probably associated with an increase in injuries to the upper limb, hand and shoulder, while injury rates to other body parts have remained fairly constant. For swings, however, the slight downward trend, if real, appears to be associated with a reduction in the number of injuries affecting the head and skull, and also the facial region. It may also be that head and facial injuries for slides have reduced modestly.

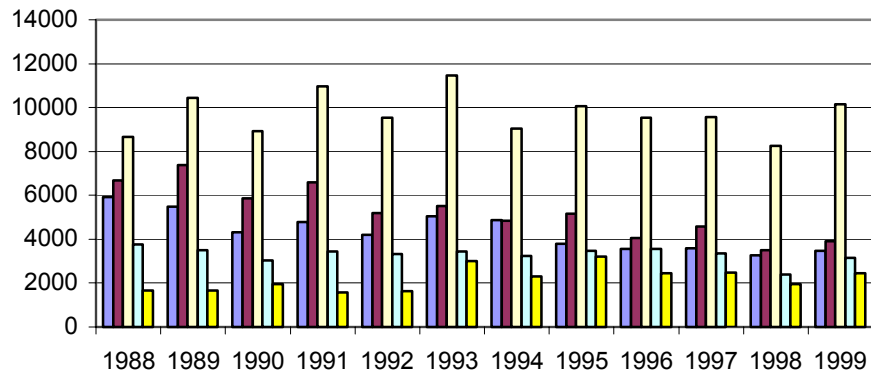
How could these apparent trends be explained? There are a number of possibilities:

- they could be attributable to anomalies in the data (for instance, these data have not been screened as were the data in Appendix A)
- the increase in climbing frame cases overall could be due to any of the following: climbing frames are more risky than they used to be: climbing frames could be more common; they could be more heavily used than before; the advent of modular equipment may mean that more accidents are simply assigned to things labelled as 'climbing frames' for want of a better term; children may have changed their behaviour e.g. taking less care and therefore more falling and jumping off if the risk of injury on landing is perceived to be lower than it actually is

Climbing frame cases



Swing cases



Slide cases

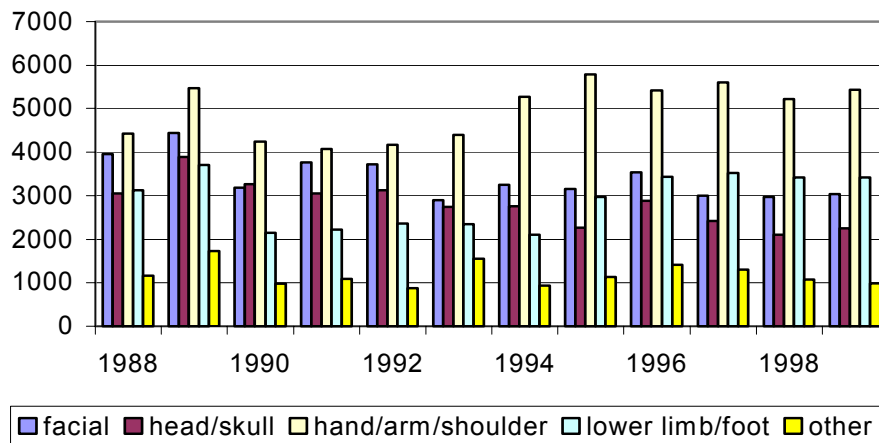
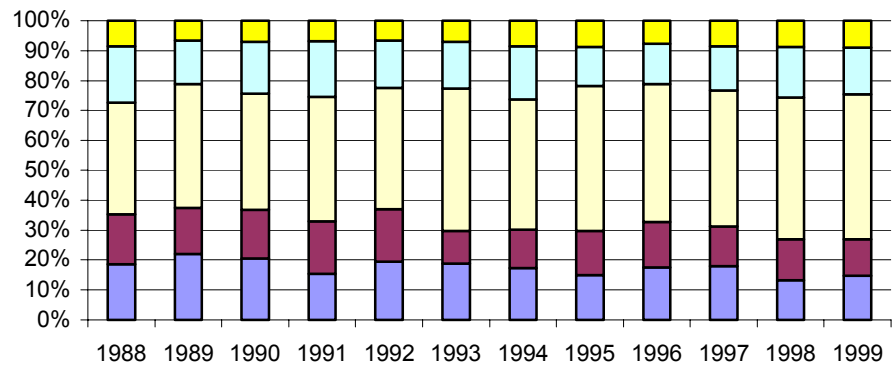
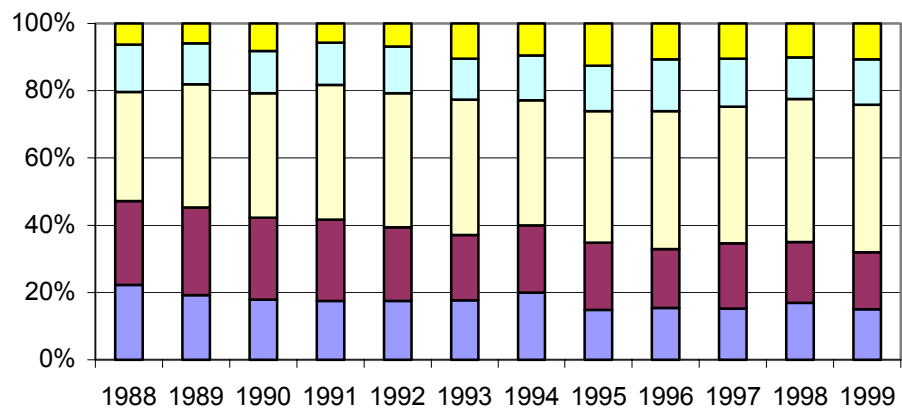


Figure B1: Annual numbers of A & E cases associated with climbing frames, swings and slides in terms of major body part(s) affected.

Climbing frame cases



Swing cases



Slide cases

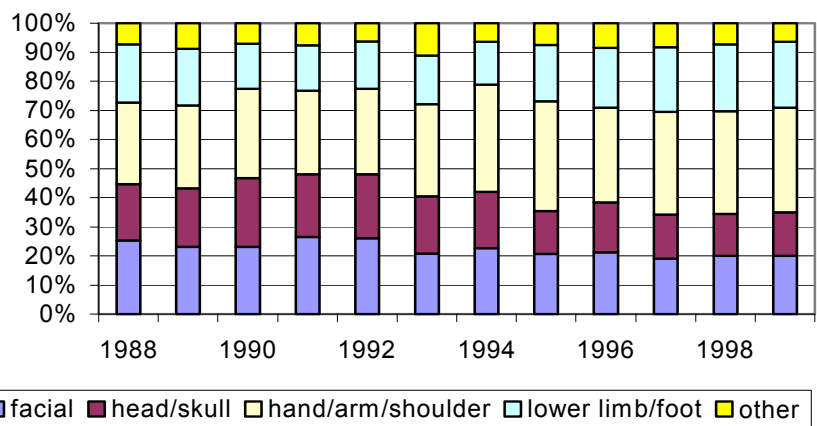


Figure B2: Percentages of A & E cases involving main body regions.

- the apparent change in the relative risk of upper limb injury versus head and facial injury might be attributable to an effect of changes in undersurfacing over the period. If the new types of undersurfacing were more kind to head and face and less kind to upper limbs, the latter either because of any behavioural adaptation of children, or the inability of IAS to reduce the risk of upper limb injuries, or a combination of these, it could explain the perceived pattern.

Overall, the strongest evidence from these data is that there has been an increase in upper limb injuries associated with climbing frames in particular, which is more or less matched by a decline in head and facial injuries associated with swings and, less convincingly, slides. Thus, the overall number of play equipment-related injuries has remained fairly constant, albeit over a period during which it is believed that children have come to spend less time in playgrounds. Whether such a tradeoff, if real, can be described as a success, depends on the relative importance of head and facial injuries versus upper limb injuries. The answer to this is not immediately obvious, as most of the injuries reported under these categories are not serious (see LASS descriptions).

APPENDIX C

RISK-BENEFIT ANALYSIS AND ALTERNATIVE PLAYGROUND SURFACING

1. INTRODUCTION

In UK policy circles it is the norm that decision making at the strategic level requires systematic economic appraisal of expenditure decisions. This has always been the basis of sound economic management and, when used properly, leads to better decisions by policy makers and managers. Thus, as stated by HM Treasury in their technical guide¹⁷⁵ for government departments (and which is recommended for use by local government and other agencies),¹²⁷ appraisal in central government is concerned with the best use of the nation's resources, and the economic analysis of major decisions should in principle be wholly in terms of economic costs and benefits. This same principle applies even in the case of non-traded goods which have no market price, for example, travel time saved by some proposed transportation scheme, or accidental deaths avoided by some safety measure. In this case, in order to make the comparison between the implementation costs of some measure and its benefits, it is necessary to use economic techniques to put a monetary value on saved time, or a human life, or a non-fatal injury. Such techniques have been devised and though they have their problems, the resulting valuations of, essentially, human safety are widely used in Britain, for example, they are used for making decisions on the amount of radiological protection warranted in hospitals, the appropriateness of safety measures in road, rail, sea and air travel, the safety of workers off-shore, and so on.¹⁷⁶ This approach to decision making has been recommended by successive British governments.^{177, 178, 179}

In addition to cost-benefit calculations, other factors may also be important in decision making about safety measures. For example, whether there are any equity issues involved, or whether, as described by Graham and Wiener,¹⁵⁰ the measures merely shift the risk from one place to another or transform it in some way. One approach to incorporating equity issues into decision making is via the HSE's 'Tolerability of Risk,' or TOR, framework.^{135, 180} This framework is, of course, also consistent with the Health and Safety at Work Act 1974 and formative case law, which, as noted earlier, requires that health, safety and welfare be managed so that risks are reduced "so far as is reasonably practicable."¹⁸¹

Figure C1 illustrates the basic principles of the TOR framework.^{134, 182} To summarise, risks may be divided into three tiers according to their magnitude. In the upper band, risks are regarded as so high as to be totally unacceptable and must be reduced even at very high cost or, if this is not possible, the activity must cease. On the other hand, for very small risks (in the region marked

¹⁷⁵ This guide is familiarly known as the 'Green Book.'

¹⁷⁶ See, for example, D. J. Ball and G. C. Goats, 'Risk management and consumer safety,' *International Journal for Consumer Safety*, 3 (3), 111-124, 1996.

¹⁷⁷ HM Treasury, 'The setting of safety standards,' 1996.

¹⁷⁸ The Cabinet Office, 'Regulation in the balance,' HMSO London, 1996. ISBN 0 7115 0317 6.

¹⁷⁹ The Cabinet Office, 'Good policy making – a guide to regulatory impact assessment,' 1999.

¹⁸⁰ Health and Safety Executive, In: 'The tolerability of risk from nuclear power stations,' HMSO, 1988. ISBN 0 11 883982 9.

¹⁸¹ The present ruling on the meaning of so far as is reasonably practicable is to be found in *Edwards v National Coal Board* (1949) 1 KB704, (1949) 1 All ER 743, 65 TLR 430, CA. This case was referred to with approval in the House of Lords in *Marshall v Gotham Co Ltd* (1954) AC 360 (1954) All ER 937.

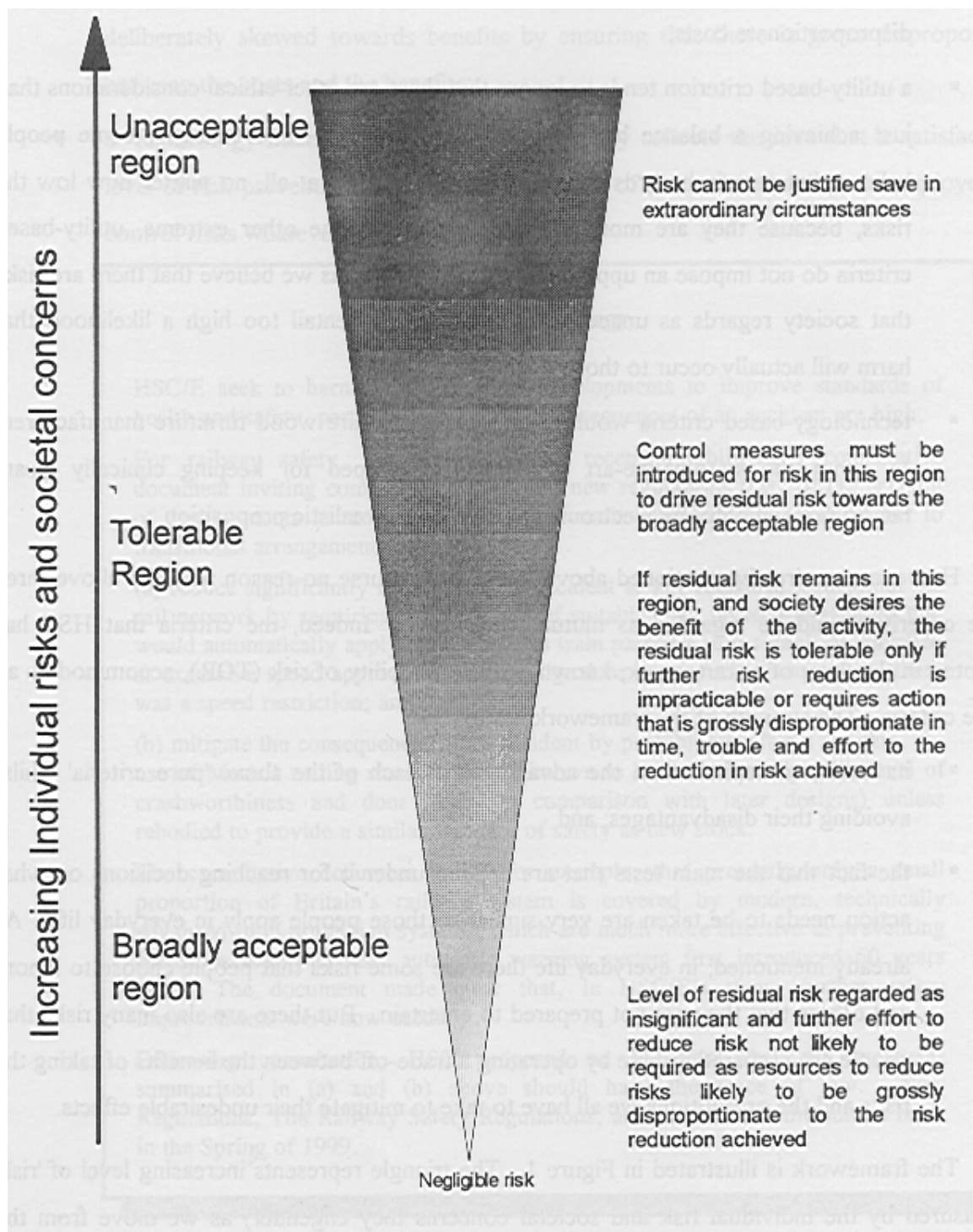


Figure C1: The HSE framework for assessing tolerability of risk.^{134, 182}

‘broadly acceptable’), it is not normally required that further significant expenditure be committed in the name of even greater safety. The intermediate region is one in which decisions on whether or not to go ahead with a risk-reducing expenditure are made with reference to the principle of ALARP (as low as reasonably practicable). The ALARP principle implies that, in making safety decisions, there is a need to carry out risk assessment and to subject the outcome to risk management decision making (i.e. to examine inter alia the balance of the costs and benefits of safety measures before deciding on whether or not to implement them).

The above partitioning of risk levels into three zones raises two important questions. First, can the risk values at the boundaries of the zones be defined? The HSE has proposed that, for the public, a risk of being killed of 1 in 10,000 per annum should represent the dividing line between what is just tolerable and what is not tolerable.¹⁸² More importantly here, the HSE believes that a risk of death of 1 in a million per year corresponds to a very low level of risk and should be used as a guideline for the boundary between the broadly acceptable and tolerable regions. This level of risk, as the HSE says, is extremely small compared with other ‘normal’ risks of life, such as being in or near road traffic, being pregnant, or taking part in certain popular sports.

The second question relates to the comparison of safety investment costs against lives saved or injuries prevented within the intermediate (ALARP) region. For risk levels close to the ‘broadly acceptable’ boundary, it is normal to exclude the notion of gross disproportion in safety investment decisions.¹⁸² Extensive research has been carried out on the monetisation of life and injury for safety investment decision making purposes in Britain during recent years. The subject is vast, but as a yardstick the most widely quoted current value of a human life for safety investment purposes in Britain is close to £1 million.¹⁸³ Because this valuation is based on research into public willingness-to-pay to reduce risk, it is said to be anchored in public values.¹⁸⁴

Despite, however, the presumed anchorage of monetary values of safety in public values, it has to be acknowledged that outside of policy circles, placing monetary values on safety can be highly controversial. The arguments for and against this approach are well-rehearsed – see, for example – the review by Soby and Ball.¹⁸⁵ The loss of any child is clearly a tragedy, yet the hard fact remains that society is unable to prevent all such events and must strive for the best allocation of the resources at its disposal. Many of those who have thought deeply about this issue hold the view that such choices can be aided, though not made, by risk-benefit calculations. Safety interventions, particularly those aimed at small risks, should also be carefully screened for the possibility of risk transfer or risk amplification mechanisms.

¹⁸² The notion of gross disproportion also originates from case law. The significance is that, for risks falling at the top of the ‘tolerable region,’ an additional weighting factor is applied in the cost benefit calculation in favour of the adoption of control measures.

¹⁸³ This is the current valuation based on the earlier study for DETR by Chilton et al., ‘New research results on the valuation of preventing fatal road accident casualties,’ In: ‘Road accidents Great Britain: 1997 Casualty report,’ UK Government Statistical Service, HMSO, 1998. ISBN 11 552068 6 0.

¹⁸⁴ As described in reference 144, the DTI Consumer Safety Unit uses a higher value of, usually, £2m to £3m.

¹⁸⁵ B. A. Soby and D. J. Ball, ‘Consumer safety and the valuation of life and limb,’ Research Report No. 9, Environmental Risk assessment Unit, University of East Anglia, 1991. ISBN 1 873933 00 2.

2. APPLICATION OF THE TOR FRAMEWORK TO PLAYGROUND SURFACING

As described in section 7.5, concern has been expressed over the effect upon play provision in the UK of the cost of impact absorbing surfaces.¹⁸⁶ For this reason alone it is appropriate to examine this approach to safety against the TOR framework and government guidelines. The first point to note is that the current individual risk of a fatal injury in UK playgrounds is, based on one fatality every three of four years and a child population of 12 million, less than 1 in 30 million per annum. There is no question that this level of risk is substantially inside the ‘broadly acceptable’ zone of Figure C1, being over 30 times below the proposed boundary value of 1 in a million per annum. As the HSE has said, for risks of less than 1 in a million, further effort to reduce risk would not normally be required as resources to reduce risks are likely to be grossly disproportionate to the risk reduction achieved. One might add that attempting to address risks as low as this is very difficult. Such attempts might also undermine the purpose and viability of the activity entirely. They might also shift the risk elsewhere, even to the point of exacerbating it.

Strictly speaking, given the above situation, further calculation might normally be considered unnecessary. However, there is some utility in attempting a rough cost-benefit analysis as it exposes issues involved in the decision process. To do this it is necessary to estimate the annual cost of provision of impact absorbing surfaces, and the annual monetised value of the reduction in injuries which this measure might bring about. This calculation is performed at a strategic (national) level.

First, to estimate the annual cost of surfacing, calculations should ideally include consideration of the entire life cycle of these products, from capital cost, to fitting, to maintenance, to disposal. Rather few data are available on this matter (the only published example found is by Kutska in the USA)⁶ and crude estimates have to be made, although these may be quite good enough depending on the outcome of the analysis (better data are only necessary if answers are borderline or if there are no other gross uncertainties present in the calculation. If there were, they would render obsolete the justification for greater accuracy). According to Association of Play Industry (API) statistics, Association members sold £14.5 million of impact absorbing surfaces in 1999.¹⁸⁷ This figure provides something of an indicator of costs, since it is a measure of ongoing capital expenditure by local authorities. It does not, of course, take any account of maintenance and upkeep costs, so is likely to be an underestimate of true costs if these surfaces require a greater level of attention than the status quo (as might be the case, say, with sand or woodchip over grass). To follow another line, it has been estimated that to fit all UK playgrounds with rubber surfacing from scratch might cost in the region of £280 million.¹⁸⁸ Were these surfaces to have an average lifetime of, say, 10 years, the crude annualised cost would be £28 million.¹⁸⁹ Of course, other surfaces, sand or woodchip, might be cheaper to buy, but require more frequent maintenance and topping up, and are not expected to yield vastly different figures.¹⁹⁰ Overall, it would appear that the costs of surfacing and maintaining the surface of all

¹⁸⁶ See also the papers by R. Sutcliffe (ibid reference 2) and P. Heseltine (ibid references 95 and 137).

¹⁸⁷ Quoted in R. Sutcliffe (ibid. reference 2)

¹⁸⁸ Based on the following assumptions: 40,000 playgrounds; 100 m² of rubber per playground, and a capital plus installation cost of around £70 per m.² (see reference 144).

¹⁸⁹ HSE normally discounts costs at 6% per annum and health and safety benefits at 2% per annum. This level of sophistication has not been entered into here because the effect would be modest in comparison with uncertainties associated with this particular topic.

¹⁹⁰ For example, in 1997 one large local authority (population ~300,000) used sand in all of its 110 public playgrounds, the annual top up cost for which was ~£25,000. Back of envelop calculations, based on a UK

UK playgrounds with special products is likely to run into the tens of millions per annum range. Perhaps a reasonable estimate is of an annual cost in the range of £20 million to £50 million for provision and maintenance of special surfaces.

The second part of the calculation concerns the amount of risk reduction which such measures might bring about. First, consider fatalities. As reported in section 2.3, the annual rate of equipment-related fatalities in playgrounds is about 0.3. However, as noted in section 3.1, causes are disparate and certainly attention to surfacing would not address all of them. Furthermore, surfacing is not expected to eliminate risk of a fatal accident even in the case of the head first falls for which they were designed. For example, the risk of severe brain injury at a HIC of 1,000 is around 20% for adults (the figure for children is unknown).⁷ The best which can be done is to make an estimate of how many lives might be saved were surfacing consistent with the usual recommendations, e.g. as in BS EN 1176, applied universally in the UK. This would be given by the following formula:¹⁹¹

$$(\text{annual no. of playground fatalities}) \times (\text{proportion of these fatalities which involve falls resulting in head impacts with the ground}) \times (\text{efficiency of these surfaces in reducing the risk of fatal injury})$$

The first term in this formula has a value of ~0.3 but a figure of 0.5 will be used to allow for potential safety benefits provided by existing impact absorbing surfaces during the period from the late 1980s to the late 1990s.¹⁹² The second term, based on the causes of fatalities occurring in playgrounds as described in sections 2.2 and 3.1 is probably in the range of 0.1 to 0.5, and the third is, say, 0.8 although this is essentially a guess because the theory is *inter alia* based on adults and not children. The result then is in the range of 0.04 to 0.2 fatalities per annum *potentially* being saved by this approach to safety.¹⁹³

To use the current DETR valuation of a human life of £1 million,¹⁸³ suggests that the equivalent monetary benefit of impact absorbing surfaces is therefore in the range of £0.04 million to £0.2 million per annum (were the higher DTI value of preventing a fatality, of £2 to 3 million used, the range would be £0.08 million to £0.6 million). On the face of it, these benefits are nowhere near the estimated costs of £20 million to £50 million and impact absorbing surfaces fail the test of reasonable practicability on this basis alone by a large margin.

In addition, one may also attempt to widen the net by considering other potential benefits and detriments of this approach to child safety. In terms of benefits, there is the widely held belief

population of 59 million, suggest about 200 such population ‘units’ in the UK, which would imply, were playgrounds provided elsewhere at the same population density, about 22,000 *public* playgrounds. If all used sand, and other things were equal, the annual top up cost, excluding any maintenance, would be ~£5 million. Maintenance costs would include, perhaps, weekly raking which, say, at one hour per playground per week and a reasonable wage would run up a national bill of ~£10 million per annum, a figure which might well be an underestimate but is adequate as an indicator. These figures would roughly double if all playgrounds were included and not just public playgrounds.

¹⁹¹ This calculation is based on the *theory* that these surfaces actually reduce risk as intended. There is no practical evidence of the validity of this proposition in the real world.

¹⁹² A crude estimate based on the following: if the underlying fatality rate in the total absence of any IAS is R, and over the period in question 50% of playgrounds had IAS, then the observed fatality rate (0.3 per annum) is approximated by $\{0.5R + 0.5R(0.1 \text{ to } 0.5)0.8\} = 0.54R \text{ to } 0.7R$, suggesting R to be in the range of 0.4 to 0.6.

¹⁹³ Here the word ‘potentially’ refers in part to the uncertainties in this estimate, but also to the possibility of risk-transfer mechanisms which might shift the risk elsewhere.

that compliant surfacing has advantages beyond its design intent in the form of reducing the risk of non-fatal injuries. In this report it has been estimated that there are about 42,000 cases annually of hospital attendances involving playground equipment (Table 8). Again, the question arises as to how effective special surfaces might be in reducing this toll were they fitted everywhere. At the moment the situation in the UK is that surfaces are fitted in some playgrounds and not others. It is absolutely clear that compliant surfaces are not anything near totally effective as injuries, both fractures and non-fractures, occur on all surface types (Table 11). Furthermore, as described in sections 4.2 and 4.3, the epidemiological evidence regarding surfaces is mixed, and neither is the biomechanical evidence entirely supportive. Nor is there any evidence of downward trends in injuries as might have been hoped during a decade or so in which many more compliant surfaces have been installed (see, for example, Table 4 of the main report).¹⁹⁴

If one were to take the work of Chalmers et al. as an example of one of the most positive findings in respect of the benefits of compliant surfacing in reducing the risk of injuries, the relative risk factor (unadjusted) for non-compliant versus compliant surfaces would be 1.79. Now what we know with fair confidence is that there were about 42,000 A & E attendances in 1998 associated with playground equipment and, of these, falls to the surface from equipment appear to account for about 50% (Table 9). If, for want of an assumption, it were taken that 70% of playgrounds had impact absorbing surfaces in 1998, it is possible to estimate the number of A & E cases if all playgrounds had had impact absorbing surfaces and the number if none had had them, by making use of the Chalmer's 'factor' of 1.79. Of course, this makes further serious assumptions, not the least being the transferability of this factor from New Zealand to the UK, and also noting for instance that the Chalmers et al. study was based on children in schools and early childhood centres, and that the number of children who actually fell on non-compliant surfaces and were injured, and on which the derivation of this factor is heavily dependent, is no more than 20 (and hence vulnerable to sampling variability). Bearing this in mind, however, suggests that, in the (unlikely) event of all other things being equal, if all playgrounds had had impact absorbing surfaces in 1998, then there would have been ~17,000 A & E attendances due to falls (compared with the 21,000 actually recorded). Likewise, if there had been no impact absorbing surfaces, the number would have been ~30,000. This suggests a potential benefit of ~13,000 less A & E attendances as being attributable to surfacing. This estimate needs to be treated with supreme caution, however. Many assumptions underlie it, and the fact is that benefits of this magnitude should be observable in, for example, the trend data in Table 4, but they are not apparent at all. However, 13,000 less A & E attendances can perhaps be regarded as a speculative estimate of the upper limit of what is theoretically achievable (subject to the various assumptions made).¹⁹⁵

To convert this into monetary terms, it is traditional to consider two types of cost: the direct financial cost of using health services and the indirect cost in terms of lost production. In recent times a third category of cost is sometimes considered, namely, welfare costs which attach a

¹⁹⁴ It has been suggested, as no more than an estimate, that the percentage of playgrounds with impact absorbing surfaces might have increased from about 20% in the late 1980s to about 80% at the present (R. Sutcliffe, personal communication).

¹⁹⁵ There are two points here. First is that the estimate is thought to be an 'upper bound' for the reason that anything bigger must surely have been visible in the trend data. Second is that the potential advantage of generating a speculative upper bound estimate is that if it turned out that even this were of little significance in the cost-benefit test, then the test would be informative.

monetary value to impaired quality of life or pain suffered.¹⁹⁶ In the case of children, the second of these, lost production costs, is barely relevant.¹⁹⁷ So far as direct costs are concerned, the HSE uses DoH estimates of roughly £52 for A & E outpatient visits, and £195 for an in-patient day¹⁹⁸ in 1996/97 prices. Strictly speaking these apply to the public at large, but the same figures will be used here as guidance. They include staff costs and supplies. For 13,000 A & E attendances, therefore, a rough cost estimate is £0.7 million to which should be added an allowance for in-patient days. Taking 9% of these visits as in-patients with a mean stay of 2.5 days yields a further cost of ~£0.6 million giving a combined total for direct costs of ~£1.3 million.

In terms of welfare, HSE has used a value for minor injuries (involving up to three days absence from work) of £125; for non-serious reportable injuries (over three days) of £1,550; and for serious injuries (involving an absence of 3 months) of £10,600.¹⁹⁹ There are some difficulties in assigning the speculated 13,000 cases to these categories which are clearly intended for the workforce. Perhaps the best that can be done is to make some estimate based on the information available from the LASS database on outcomes of A & E visits. It is proposed that perhaps 60 to 80% of the cases might fall in the ‘minor injuries’ category, 10 to 30% in the ‘over three days’ category, and 0.5 to 3% in the ‘over 3 months’ category. Combining the resulting monetary values with numbers of projected cases in each category results in total welfare costs for these cases of from £4 million to £12 million.

Costs of IAS	£ millions per annum	Reliability and validity of estimate	Benefits of IAS	£ millions per annum^a	Reliability and validity of estimate
Capital and maintenance	20 to 50	Moderate	Fatality avoidance	0.04 to 0.2	Moderate to speculative
Risk transfer mechanism	???	No estimate is currently feasible	Injury reduction - avoided direct costs - avoided welfare costs	2.6 ^b (? to) 8 to 24 ^{b, c}	- Moderately speculative - Highly speculative
Play value	???	Unknown. Could be positive or negative	Play value	???	Unknown. Could be positive or negative

Table C1: Summary of costs and benefits associated with impact absorbing surfaces (IAS).

^aValues of safety in this column are based on DETR and DoH figures.

^bThese figures include an allowance of x2 for non A & E attendances.

^cAlthough a range of £8m to £24m is estimated, this does not mean that values outside of this range are inconceivable. In particular, this range is anchored in the ‘Chalmer’s factor’ which would project a rather large benefit from IAS in terms of reduced injuries, but this has not been observed suggesting, perhaps, that compensatory mechanisms of the kind described by Graham and Wiener¹⁵⁰ and others may be active.

¹⁹⁶ This component is not always considered. For example, the Sports Council study of injuries in sport (ibid. reference 26) does not include welfare costs.

¹⁹⁷ It can be argued that guardians may lose work time as a result of a child’s accident, but this is not considered here as it is an unwarranted level of sophistication in view of major uncertainties in other quantities.

¹⁹⁸ Health and Safety Executive, ‘The costs to Britain of workplace accidents and work-related ill health in 1995/96,’ HMSO, 1999. ISBN 0 7176 1709 2.

Thus, the combined direct and welfare costs of 13,000 ‘potentially-avoidable’ fatal and non-fatal playground injuries emerges as in the region of £5 million to £14 million, of which very little is associated with the avoidance of fatalities and most with welfare costs of injuries. This calculation only deals with those cases attending A & E departments. Many more attend other medical outlets, or go home (see Table 8), and although these cases are expected on average to be less severe they would further enhance this figure, perhaps, say, by a factor of two, although this is hard to say, and also encounters the philosophical problem of whether all injury experiences are, per se, bad and not a learning experience or just a part of every day life. Such questions transcend cost-benefit and science.

The results of this computation, summarised in Table C1, demonstrate that the decision on the viability of impact absorbing surface as a safety measure cannot be answered scientifically. The imponderables are too large for the following principal reasons:

- the effectiveness of the measure is in practice unknown. While there is scientific evidence of a (relatively weak) association between the presence of impact absorbing surfacing and reduced risk of injuries, the database involved is small, and the extrapolation of this association to the UK is of uncertain validity. Furthermore, there is no practical evidence of an overall downward trend in playground injuries during a time when many of these products have been introduced
- the monetary valuation of the above uncertain injury reduction is a source of further considerable uncertainty, particularly as the dominant component is one of human welfare costs and there are philosophical questions about its application in this example
- the cost of implementation of the measure is subject to some uncertainty
- in the wider picture it is necessary to consider possible risk transfer mechanisms. The cost of this safety measure (IAS) adds considerably (~25%) to the overall cost of provision of playgrounds. Anecdotal evidence suggests this is one factor leading to a reduction in provision. It is plausible, and there is a little evidence to support it, that reduced provision transfers risk to other locations to which children are displaced, possibly exposing them to greater risk than that to which they had been used in unmodified playgrounds
- a further issue is the association between ‘play value’ and surfacing. On the one hand, surfacing, costs of provision, and play value interact in a complex and little understood fashion. On the other hand, some issues are more straightforward, for example, some surfaces have intrinsic play value, and this might therefore figure in the cost-benefit equation. Sand, for example, has obvious play value for young children, and grass has the benefit of being natural - naturalness being a valued commodity so far as the public are normally concerned.¹²⁴ Grass has, of course, been generally criticised as a playground surface on the grounds of alleged poor impact attenuation but there is little evidence on this matter. Quite often, grass has been arbitrarily assigned to the same category as concrete, though in the temperate British climate this may be an injustice.

APPENDIX D

THE APPLICATION OF CULTURAL THEORY TO PLAYGROUNDS

A full account of Cultural Theory (CT) can be found in ‘Divided we stand’,¹⁹⁹ but in essence, societal conflicts can be approximated by the interactions of just four contrasting world views. With reference to Figure D1, *hierarchists* tend to want social prescription and favour societies run by rules; *egalitarians* have little respect for externally imposed rules and seek democracy and equality; *individualists* are relatively free of control by others and fit more the role of entrepreneurs and opportunists, and *fatalists* perceive little control over their lives and by and large miss out.

According to CT, and perhaps surprisingly: four is usually a sufficient number of rationalities to explain all social interactions; each rationality depends on the existence of the others for its existence; and it cannot be said that any particular one of the four rationalities is ‘right’ in the absolute sense because each has its own logic.

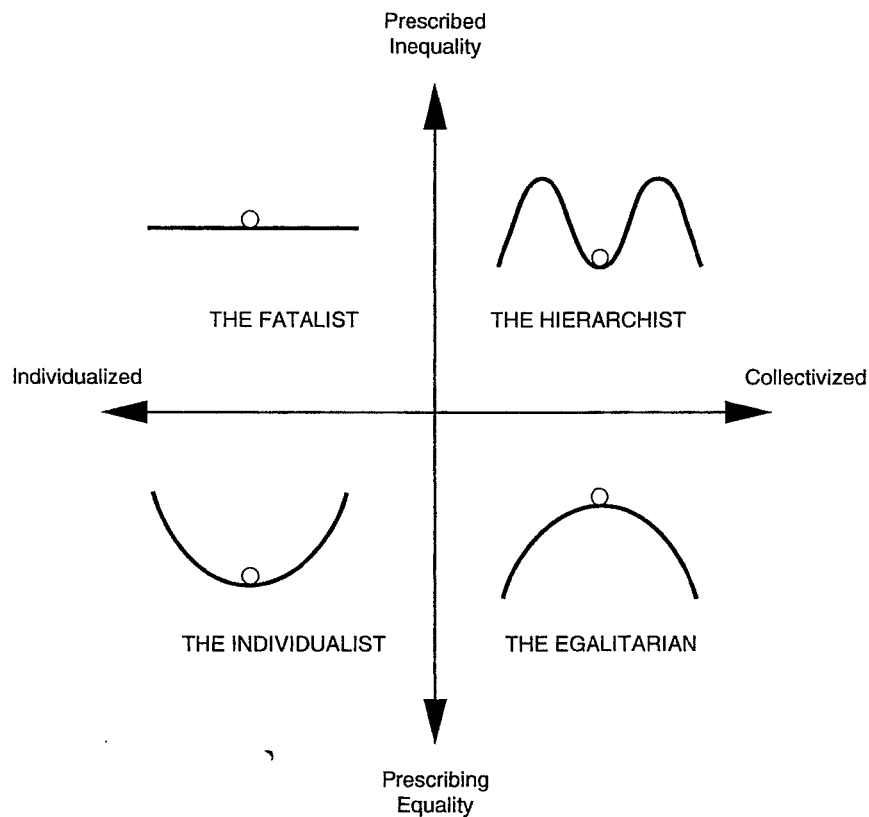


Figure C1: The four rationalities according to Cultural Theory.²⁰⁰

What has this to do with playgrounds? Figure D2 contains a sample of views expressed about play and playgrounds which suggests that all four cultural perspectives are alive (though not

¹⁹⁹ M. Schwarz and M. Thompson, ‘Divided we stand – redefining politics, technology and social choice,’ Harvester Wheatsheaf, 1990. ISBN 0 7450 0787 2.

necessarily thriving) in the play world. While the quotes in Figure D2 are attributed to various not mean that the authors are of that cultural persuasion. Indeed, some authors appear in more than one box, and many are merely quoting someone else, or demonstrating some issue which is not necessarily their own e.g. how commercial interests adapt to the individualistic mode. The point is simply to show that the four perspectives exist. To grossly simplify, hierarchists favour compliance with standards as the solution, egalitarians want a holistic approach centred on play value, individualists maximise opportunities – whatever the market wants or will bear, and fatalists are, in this example, perhaps best represented by children who are all too infrequently consulted.

According to CT, in order to manage this at first sight intractable state of affairs, the primary task is to ensure that all four voices are heard in the debate.^{200, 201} To encourage this would certainly be the task of the regulator, and support could also be garnered by national agencies with interests in play. Failure to include all four perspectives is likely to lead to unbalanced decisions and perhaps generate the kind of ‘societal concern’ referred to by J. Le Guen in ‘Reducing risk – protecting people.’¹³⁴

²⁰⁰ J. Adams, D. J. Ball, S. Boehmer-Christiansen and M. Thompson, ‘Societal concerns’, report to the HSE, in preparation.

²⁰¹ Note that J. Graham and J. Wiener (ibid reference 150) also identify the “omitted voice” as a prominent source of narrow decision making. Decision maker’s actions are more likely to be defined by voluble constituencies than by non-participants who, nonetheless, may have important contributions to make in the formulation of complete solutions. D. Seedhouse (ibid reference 92) also describes, from a philosophical angle, how different value systems result in different ‘solutions’ to the same problem. Thus, Cultural Theory is by no means the only arrow pointing in this direction.





<p> Fatalist</p> <ul style="list-style-type: none"> • “Well adults won’t listen to us anyway, so what’s the point?” Quoted by P. Reed, 1999 • “Children do not value the playgrounds we provide – it’s not what they want or what they need. We don’t listen because we don’t really want to hear. Providing what children must have to be able to develop is expensive (today’s cardinal sin), time consuming and demands commitment by people.” P. Heseltine p 92, 1995 	<p> Hierarchist</p> <ul style="list-style-type: none"> • “Because of the lack of effective regulations, lack of understanding of play equipment standards, and spotty enforcement, child care active play areas are generally very unsafe.” B. Caesar, 1999 • “Every time someone gets accidentally injured, someone, somewhere made a mistake. God ain’t doing this stuff, we are.” J. L. Frost (quoting Red Duke) p 65, 1995 • “Schools must raze unsafe play areas.” Headline, The Toronto Star, 7 July 2000
<p> Individualist</p> <ul style="list-style-type: none"> • “Have you had an injury in the last three years? If so, call us.” UK TV and billboard advertisement for legal services • “Shock absorbancy is the sine qua non of playground surfacing.” W. J. Henderson p73, 1995 • “The advantages of today’s soft-contained play equipment are that while they address the physical and mental values of play for children, they also are seen as safe, clean and fun. Because of limited time parents have with their children.....” J. Beckwith (McDonald’s Corp Global Safety Officer), 1999 • “The safety standards and recommendations for public playground equipment that have been developed in recent years have made playgrounds safer places but have also served as the fuel for litigation.” T.B. Hendy, 1999 • “..we are finding that councils and schools are opting for the stereotypical manufactured static play equipment so they can reduce their maintenance and , they believe, reduce their level of liability – which we all know is a fallacy.” P. Reed, 1999 • “While efforts to use qualified playground equipment installers are still in their infant stage, there is one very clear underlying factor that motivates playground owners to seek a professional installation: protection from litigation.” C. L. Stoddard, 1999 	<p> Egalitarian</p> <ul style="list-style-type: none"> • “It is worse to have too much regulation than too little.” J. Richter, p142 MLC V1 • “We have made playgrounds so safe that children are forced to find their way round the safety measures solely to be able to enjoy themselves and play – and have accidents as a result.” P. Heseltine, 92, 1995 • “Risk taking is a natural and desirable aspect of children’s play that they will seek out themselves.” Best Play¹ • “...small risks are part of a child’s growing up and character training, and that it will fit them better for the fast changing world in which new hazards are likely to come into being. This will lead to minimising accidents and children learning to avoid more serious risks through childhood and their later life.” E. Stutz, 1999 • “Behind “play value” comes – measured in terms of importance for the children – once again play value and then again play value and perhaps then the concern about safety.” J. Richter, p 140, 1995 • “Taking risks helps children to learn.” Headline, The Toronto Star, 7 July 2000. • “Let’s assume play as being a necessity in order for children to acquire skills enabling them on their way into the strange world of adulthood. Let’s also assume that play involves risk assessment and management; and if children learn to manage while being in a challenging play environment, they will know how to better cope with all the things they will get exposed to outside the playground.” M. T. Jensen, p113, 1995

Figure D2: Some views from the playground world arranged according to Cultural Theory. Unless indicated otherwise, all quotes are from the 1995 and 1999 proceedings of the Penn State conferences.⁸⁷

**MAIL ORDER**

HSE priced and free
publications are
available from:
HSE Books
PO Box 1999
Sudbury
Suffolk CO10 2WA
Tel: 01787 881165
Fax: 01787 313995
Website: www.hsebooks.co.uk

RETAIL

HSE priced publications
are available from booksellers

HEALTH AND SAFETY INFORMATION

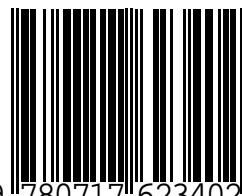
HSE InfoLine
Tel: 08701 545500
Fax: 02920 859260
e-mail: hseinformationservices@natbrit.com
or write to:
HSE Information Services
Caerphilly Business Park
Caerphilly CF83 3GG

HSE website: www.hse.gov.uk

CRR 426

£20.00

ISBN 0-7176-2340-8



9 780717 623402